SPECTRAL DYNAMICS CORPORATION

SERIAL 13

# INSTRUCTION MANUAL

# 13175-3/13176 HARD COPY ADAPTER/ HARD COPY PRINTER

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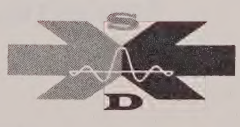

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| DWG. NO. 27550200 | Component Layout (Power Supply – Circuit Card A1) |
| DWG. NO. 27550000 | Schematic, Circuit Card A1, Power Supply |
| DWG. NO. 27550500 | Component Layout (X-Y Control – Circuit Card A2) |
| DWG. NO. 27550300 | Schematic, Circuit Card A2, X-Y Control |
| DWG. NO. 27550800 | Component Layout (Scan Converter/Printer Control – Circuit Card A3) |
| DWG. NO. 27550600 | Schematic, Circuit Card A3, Scan Converter/Printer Control |
| DWG. NO. 27551700 | Interconnect |
| DWG. NO. ~~19561~~ 19585 | Printer Drive |

# PREFACE

## RECEIVING INSPECTION PROCEDURE

The Models 13175-3/13176 Hard Copy Adapter/Hard Copy Printer are shipped fully assembled, packed in polystyrene cases designed to protect them against all normal shipping hazards. Immediately upon receipt, inspect the exterior of the shipping case and note any visible damage. Keep all forms and invoices attached to the shipping case. Remove the instruments from the shipping case and test their functional operation. If shipping damage is apparent, file a claim with the carrier's claims agent and send a copy to Spectral Dynamics Corporation. Be sure to include the instrument name, model number, and serial number on all correspondence. Spectral Dynamics Corporation will advise the buyer what should be done; arrangements for repair or replacement will be made as applicable.

## WARRANTY POLICY

All Spectral Dynamics products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain components listed in some of the operating manuals, for the specified period. We will repair or replace products which prove to be defective during the warranty period, providing the failure or damage has not been caused by misuse or abnormal operating conditions. Fuses and lamps are specifically excluded from warranty. If the malfunction or a portion thereof is determined by Spectral Dynamics Corporation to have been caused by misuse or abnormal conditions of operation, an estimate of cost to repair will be submitted to the purchaser for approval before beginning any repair work.

Liability under this warranty is limited to servicing and adjusting the instrument returned to the factory, with transportation charges prepaid by the purchaser. No other warranty is expressed or implied. We are not liable for consequential damages.

If any malfunction develops, notify Spectral Dynamics Corporation or its representative in your area, giving details of the problem, and the name, model and serial number of the equipment. Upon receipt of this information, service data or shipping instructions will be provided.

## RETURN SHIPMENT PROCEDURE

On receipt of shipping instructions, forward the instrument prepaid via air freight to the factory or authorized repair station indicated on the instructions. Replace the instrument in its original shipping case, or surround with two to three inches of shock absorbing material and then pack it in a heavy-weight cardboard box, wooden box, or other strong container.

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# SECTION I
# GENERAL INFORMATION

## 1.1 INTRODUCTION

The Spectral Dynamics Models 13175-3/13176 Hard Copy Adapter/Hard Copy Printer are designed to work in conjunction with the SD301 Real Time Analyzer, the Model 5001-1, or the Model 5001-6 system to generate a spectrum X-Y plot and a spectrum history printout on dry electro-sensitive paper.

The 13175-3/13176 units consist of a Hard Copy Adapter (13175-3) and a Hard Copy Printer (13176) connected in one of the configurations as illustrated in Figure 1-1a, b or c.

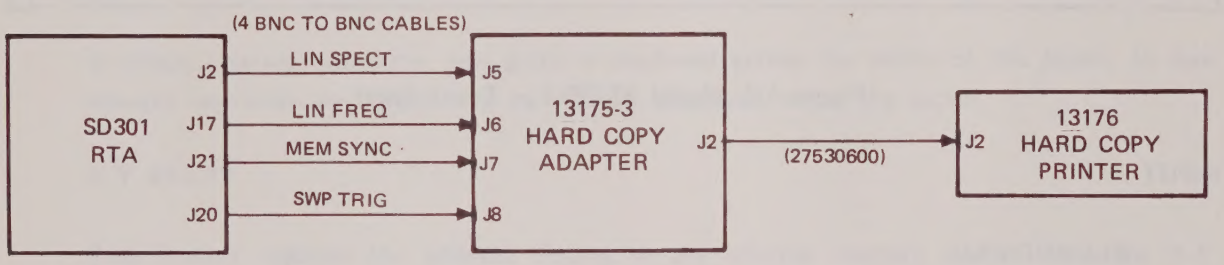



Figure 1-1a. Interconnect with SD301 RTA

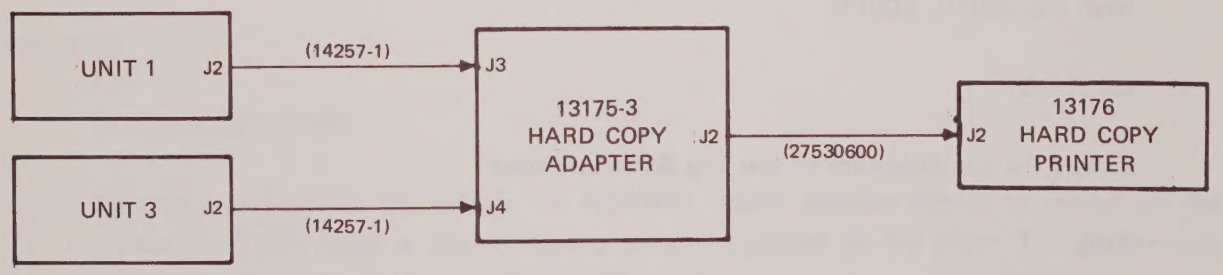



Figure 1-1b. Interconnect with Model 5001-1 System

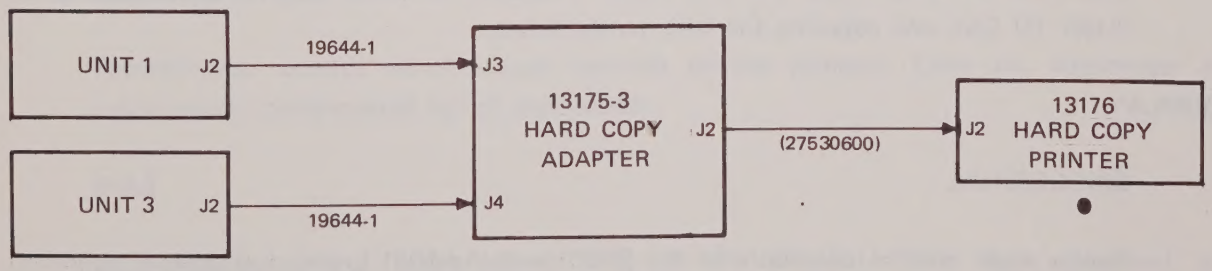



Figure 1-1c. Interconnect with Model 5001-6 System

## 1.2 MODEL 13175-3 FRONT PANEL FUNCTIONAL DESCRIPTION

Figure 1-2 illustrates the instrument front panel. A brief description of each of the front panel functions follows.

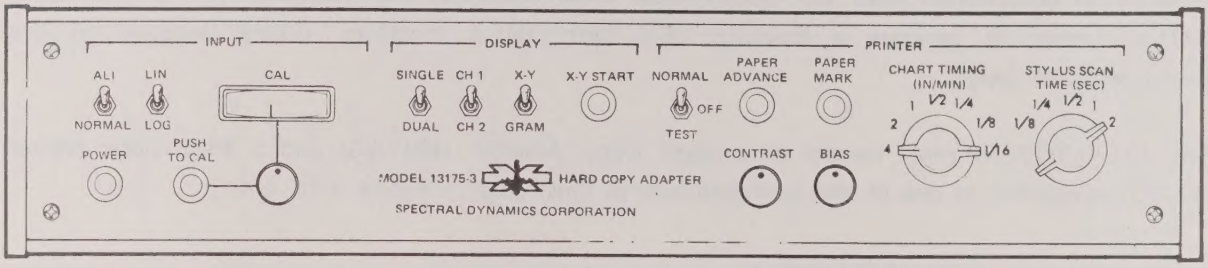



**Figure 1-2. Model 13175-3 — Front Panel**

### INPUT

#### ALI/NORMAL

Selects the Lin Spectrum from the SD301, 5001-1, 5001-6 or the Averaged Lin Spectrum from the 5001-1, 5001-6.

#### LIN/LOG

Selects the Lin Spectrum or the Log Spectrum input.

#### CAL

Provides a method of adjusting the full scale of the X-Y plot. With the SD301, 5001-1, 5001-6 in the CAL mode, the CAL meter is adjusted to center position by depressing the PUSH TO CAL and adjusting the CAL potentiometer.

### DISPLAY

#### SINGLE/DUAL

Selects single channel operation for the SD301 and the 5001-1, and dual channel operation for the 5001-6.

### CH1/CH2

Selects the desired channel for X-Y display when in the dual channel mode. This switch is disabled when in single channel operation, and GRAM display.

### X-Y/GRAM

Selects the desired display. In X-Y mode, displays the X-Y plot of selected signal superimposed on an internally generated grid representing magnitude vs. frequency.

In the GRAM mode, displays the selected signal as 15 shades of gray intensity modulated line, with white representing weak signals and black representing strong signals. In GRAM mode, the X axis represents frequency and the Y axis represents time.

In single channel operation, one gram is displayed across the width of the paper. In dual channel operation two grams side by side are displayed across the paper.

### X-Y START

Push button registers the selected display in the internal memory and initiates the X-Y plot. The printer automatically stops at end of plot.

## PRINTER

### NORMAL/OFF/TEST

Controls operation of the printer. In NORMAL mode, selected display is printed on the printer. In TEST mode, a 15-step shading pattern is printed on the paper. This pattern aids in adjustment of the BIAS and CONTRAST controls.

### CONTRAST

Potentiometer control which adjusts contrast of the printout. Once set, adjustment is automatically compensated for all styli speeds.

### BIAS

Potentiometer control which adjusts bias of the printout. Once set, adjustment is automatically compensated for all styli speeds.

PAPER ADVANCE

Push button control for paper feed at a rate of 16 in./min.

PAPER MARK

Push button control for writing dark lines on printout.

CHART TIMING (IN/MIN)

Selector switch for control of paper advance speeds; selectable speeds of 4, 2, 1, 1/2, 1/4, 1/8, 1/16 inches per minute.

STYLUS SCAN TIME (SEC)

Selector switch for control of stylus speed; selectable speeds of 1/8, 1/4, 1/2, 1, and 2 seconds per scan.

## 1.3 MODEL 13175-3 REAR CHASSIS FUNCTIONAL DESCRIPTION

Figure 1-3 illustrates the rear of the instrument chassis. A brief description of each of the input/output functions follows.

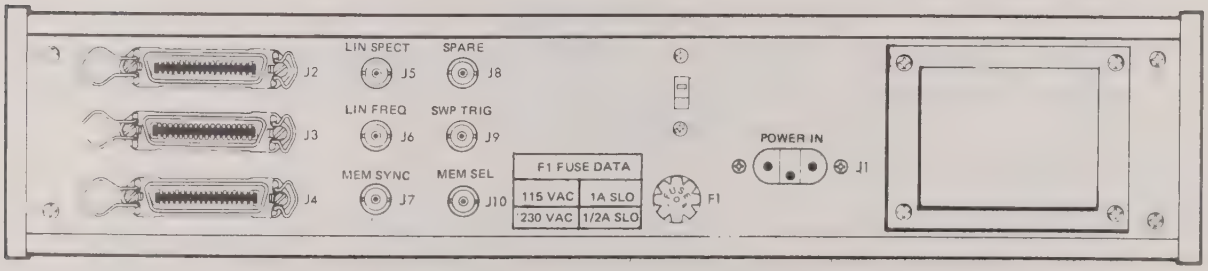



**Figure 1-3. Model 13175-3 — Rear of Chassis**

(J2)

Accepts interconnection cable from Model 13176 Hard Copy Printer. This cable contains all signals required to control the Hard Copy Printer.

**(J3, J4)**

Accepts interconnection cable from the Model 5001-1 or 5001-6 system. These cables contain all the input signals required by the Hard Copy Adapter. Connections between J3 and J4 are pin to pin.

**LIN SPECT (J5)**

Lin Spectrum input from the SD301. 0 to 5 Vdc; one step for each of 500 synthesized filter locations.

**LIN FREQ (J6)**

Lin Frequency input from the SD301. 0 to 5V (nominal) smooth ramp.

**MEM SYNC (J7)**

Memory sync input from the SD301. 0 to 5 Vdc; approximately 2 microsecond pulse every time the memory recirculates.

**SPARE (J8)**

No connection.

**SWP TRIG (J9)**

Sweep trigger input from the SD301. Transition from 5V to 0V that is synchronized with start of each sweep; transition is back to 5V at end of sweep.

**MEM SEL (J10)**

Monitor connection for memory select signal when used with 5001-6 system, 0 to 5 Vdc transition; 5 Vdc indicating channel one and 0 Vdc indicating channel two.

**POWER IN (J1)**

Accepts 3-wire plug and cable (supplied) for applying 115/230 Vac 50–400 Hz primary input power. Center terminal is chassis ground. Uses Belden No. 17258-S cable.

**FUSE, F1**

Contains 3AG type, SLO-BLO fuse; 1A for 115V, or 1/2A for 230V.

### 115/230 SWITCH

Facilitates changeover of primary power input circuit for either 115V or 230V operation. Proper input voltage to be applied shows in window; screwdriver blade slot is up for 115V operation and down for 230V operation.

## 1.4 MODEL 13176 FRONT PANEL FUNCTIONAL DESCRIPTION

Figure 1-4 illustrates the instrument front panel.

**Figure 1-4. Model 13176 — Front Panel**

The Hard Copy Printer is equipped with a front-loading, retractable paper advance assembly accessible at the front panel window. The window swings open and locks in place for loading a 120-foot-long and 11-9/16" wide NDK type electro-sensitive paper roll.

## 1.5 MODEL 13176 REAR CHASSIS FUNCTIONAL DESCRIPTION

Figure 1-5 illustrates the instrument rear chassis followed by a brief description of each of the functions.

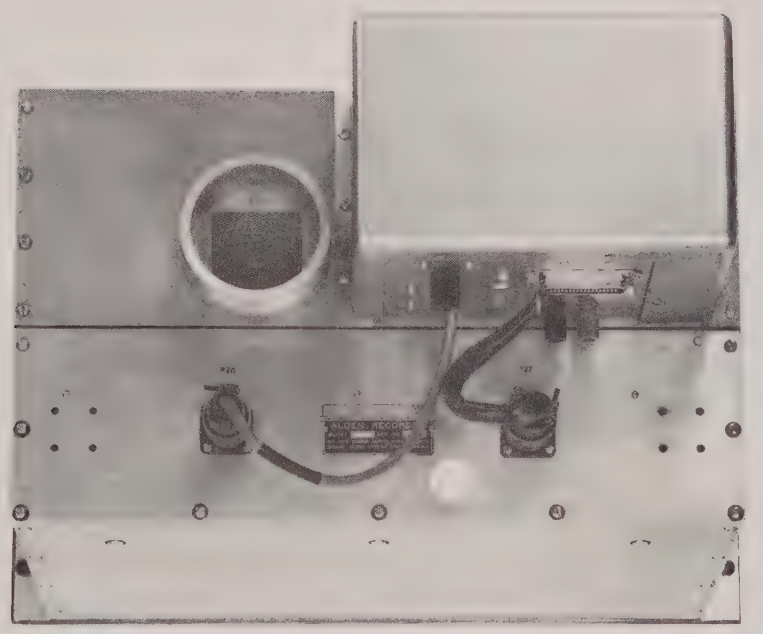


**Figure 1-5. Model 13176 — Rear Chassis**

**(P26)**

Connects power to J26, the fan of the Hard Copy Printer.

**(P27)**

Connects all the drive signals to J27, the Hard Copy Printer.

**(J3, J4)**

Contact closure when the Hard Copy Printer is running.

**(J2)**

Connects all control signals from the Hard Copy Adapter.

**POWER IN (J1)**

Accepts 3-wire plug and cable (supplied) for applying 115 Vac 50—400 Hz primary input power. Center terminal is chassis ground. Uses Belden No. 17258-S cable.

FUSE

Contains 3AG type, 2-1/2 Amp SLO-BLO fuse.

## 1.6 SPECIFICATIONS

INPUT

From SD301 RTA, 5001-1, or 5001-6 System

| | |
|---|---|
| Lin Step Spectrum | 0 to 5 Vdc output; one step for each of 500 synthesized filter locations. |
| Lin Frequency | 0 to 5V (nominal) smooth ramp. |
| Sweep Trigger | Transition from 5V to 0V that is synchronized with the start of each sweep; transition is back to 5V at end of sweep. |
| Memory Sync | 0 to 5V, approximately 2 microsecond pulse every time the memory recirculates. |
| Memory Select (used with 5001-6) | 0 to 5 Vdc square wave; 5V indicating channel 1 and 0V indicating channel 2. |
| ALI (Averaged Lin Spectrum) (used with 5001-1, 5001-6) | 0 to 5 Vdc; one step for each of 500 synthesized filter locations. |

OUTPUT

Hard copy Spectrum Printout on 11-9/16" wide (10.7" active scan) electro-sensitive paper of NDK type. The following printouts are obtainable from the hard copy printer.

1. A single 15-step intensity modulated history printout corresponding to magnitude of the spectrum across the active scan.

2. Two 15-step intensity modulated history printouts corresponding to magnitude of the spectrum for each of the two channels, with channel one displayed during the first half of the scan and channel two during the second half.

3. An X-Y printout of the Lin Spectrum or the Averaged Lin Spectrum superimposed on a grid as shown in Figure 1-6.

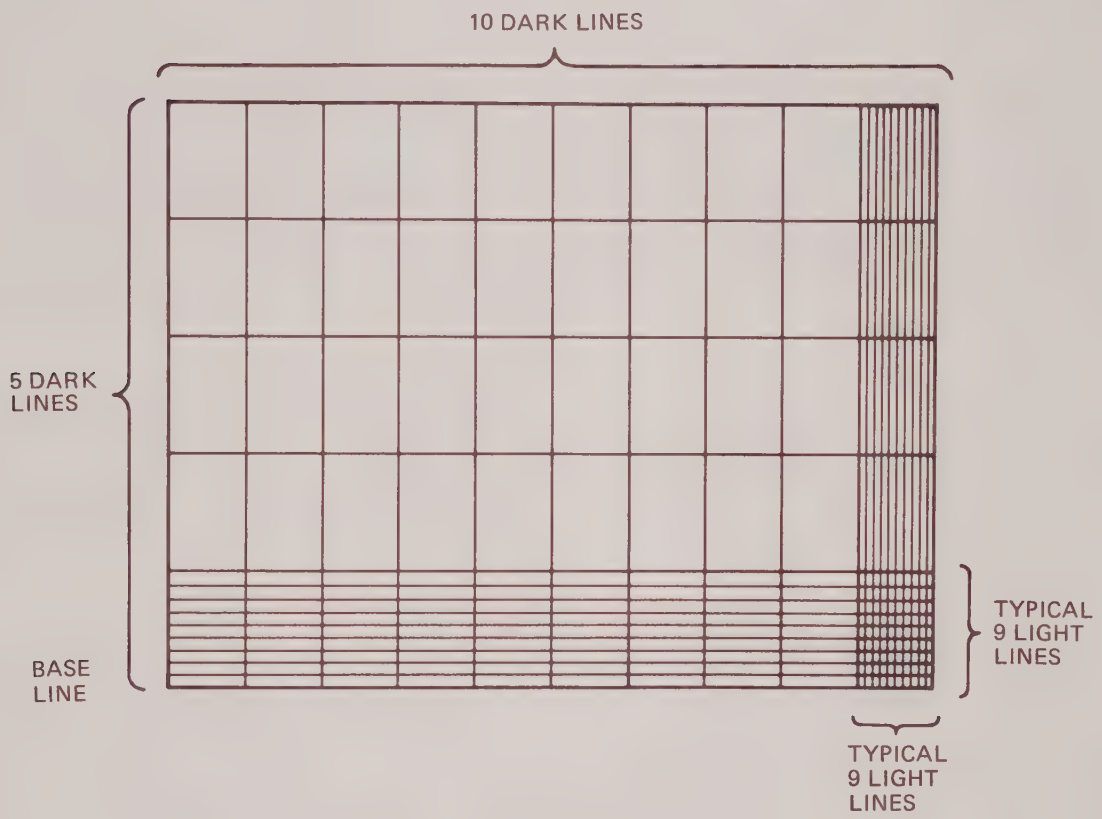



**Figure 1-6. X-Y Grid**

CALIBRATION . . . . . Full scale adjustment of input magnitude for X-Y plot.

POWER . . . . . 105–125 Vac, 50–400 Hz.

DIMENSIONS:

| | | |
|---|---|---|
| Hard Copy Adapter (13175-1) | Height | 3-1/2" |
| | Width | 19" |
| | Depth | 18" |
| | Shipping Weight | 10 lb |
| Hard Copy Printer (13176) | Height | 10-1/2" |
| | Width | 19" |
| | Depth | 15" |
| | Shipping Weight | 68 lb |

# SECTION II
# OPERATION

## 2.1 GENERAL

The SDC Models 13175-3/13176 were designed to be used as an integral part of the SD301 Real Time Analyzer, the 5001-1, or the 5001-6 systems. The procedures described here are basic to the 13175-3/13176. The operator should refer also to the system instruction manual for setup and operating instructions applicable to the system operation. It is recommended that the operator study the functional descriptions of the front panel and rear chassis controls, indicators, and connectors in Section I.

## 2.2 OPERATIONAL CHECKOUT PROCEDURE

The following procedure should be performed upon receipt of the instrument and after maintenance to ensure correct overall operation.

**Model 13175-3 Set-up**

a. Remove the 13175-3 instrument top and bottom covers and inspect for overall physical integrity. Replace the top cover.

b. On rear chassis, check that the 115/230 switch is set according to the input line voltage and that a fuse with correct rating is installed.

c. Connect power cord from J1 POWER IN to primary source; press the POWER switch/indicator; it should light to indicate power is applied to all internal circuits.

**Model 13176 Set-up**

a. Loosen the 13176 front panel locking thumbscrews and swing the window to the open position. Lock the window in the open position by sliding the two latches on the inside of the window.

b. Open the paper drive assembly by raising the two levers upward while pulling on the assembly in a down and out motion.

c. Rotate left pulley CCW.

d. Position pin and styli as shown on plate in front of styli.

e. Release belt tension by turning TENSION RELEASE knob CCW to detent.

f. Remove belt from right pulley first.

g. Carefully flex belt to U-shape.

**CAUTION**

**Do not lift or distort flat spring.**

h. Insert styli provided in the attached bag (3).

i. Install belt with arrow in sweep direction. (See chart in front of pulley.)

j. Engage belt pin on left pulley.

k. Position belt over right pulley.

l. Engage tension slowly by rotating TENSION RELEASE knob CW.

m. Rotate belt CCW and check pin engagement.

n. Close the paper drive assembly and the front window.

o. Connect power cord from J1 POWER IN to primary source.

**System Set-up**

a. Connect cable 27530600 to J2 of 13176 and to J2 of 13175-3.

b. Interconnect the adapter per system used as shown in Figure 1-1.

**System Checkout**

a. Set switches and controls on Model 13175-3 as shown in Table 2-1.

Table 2-1. Control Setting

| CONTROL | SD301 | 5001-1 | 5001-6 |
|---|---|---|---|
| ALI/NORMAL | NORMAL | NORMAL | NORMAL |
| LIN/LOG | LIN | LIN | LIN |
| SINGLE/DUAL | SINGLE | SINGLE | DUAL |
| CH1/CH2 | CH1 | CH1 | CH1 |
| X-Y/GRAM | GRAM | GRAM | GRAM |
| NORMAL/OFF/TEST | OFF | OFF | OFF |
| CONTRAST | MID RANGE | MID RANGE | MID RANGE |
| BIAS | MID RANGE | MID RANGE | MID RANGE |
| CHART TIMING | 2 IN/MIN | 2 IN/MIN | 2 IN/MIN |
| STYLUS SCAN TIME | 1/4 SEC | 1/4 SEC | 1/4 SEC |

b. Allow 1/2 hour warm-up for best printout.

c. Set NORMAL/OFF/TEST switch to TEST and adjust CONTRAST and BIAS potentiometer for 15 shades of gray from full white to full black (displayed from left to right). For the 5001-6, two shading patterns appear across the scan length.

d. Rotate STYLUS SCAN TIME switch to all positions, and repeat Step c. The writing intensity should remain approximately the same. Return switch to previous setting.

e. Rotate CHART TIMING switch and verify that the paper advances at the selected speeds. Return switch to previous settings.

f. Set SD301, 5001-1, 5001-6 (both channels), to FREQUENCY MARK.

g. Set NORMAL/OFF/TEST switch to NORMAL. Observe ten frequency marker lines. For 5001-6, two sets of ten frequency markers appear across the scan length.

h. If the minor marker does not start on the left edge of paper, adjust the tach by loosening the tach adjust Allen-Head screws (2) on Hard Copy stylus drive motor and rotate the Tach Pulley with respect to the stylus belt (see Figure 2-1). Tighten the Allen-Head screws and repeat Step g.

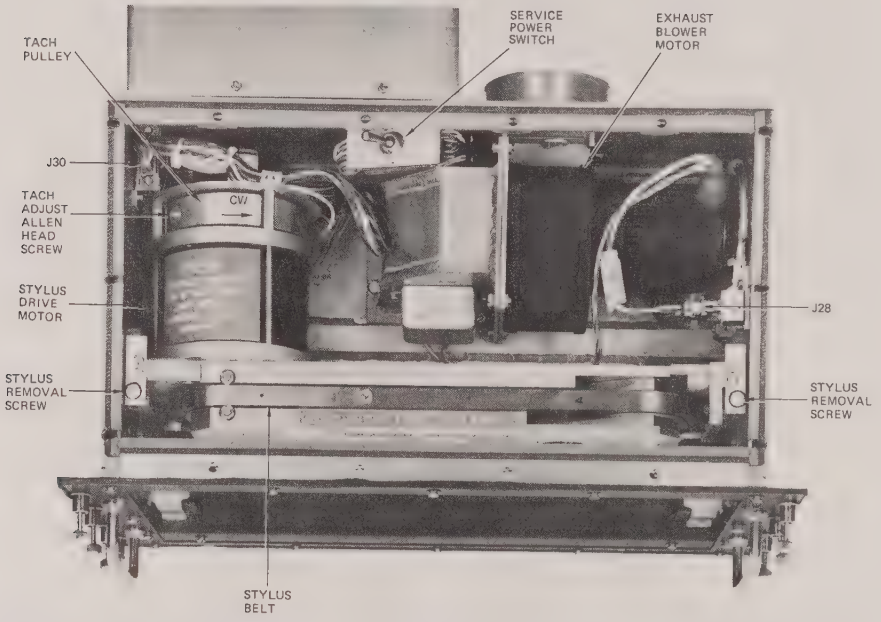



**Figure 2-1. Model 13176, Tach Adjustment**

i. Press the PAPER MARK button to write a dark line across the paper.

j. Set the NORMAL/OFF/TEST switch to OFF.

k. On the SD301, turn the FREQUENCY MARKER to OFF and set SPECTRUM CAL to 0 dB. On the 5001-1, set INPUT to TEST. On the 5001-6, set channel 1 INPUT to TEST and channel 2 INPUT to an unused input.

l. Set X-Y/GRAM to X-Y, depress the PUSH TO CAL button and adjust the meter for center reading.

m. Set NORMAL/OFF/TEST to NORMAL and depress X-Y START. Observe that the peak of the signal coincides with the top heavy line on the X-Y plot. The printer automatically stops at the end of the X-Y plot.

n. Press PAPER ADVANCE. The paper will advance at a fast rate.

o. Set SD301 FREQUENCY MARKER to ON and SPECTRUM CAL to OPER. Set 5001-1 and 5001-6 (both channels), to FREQUENCY MARK.

p. Set NORMAL/OFF/TEST switch to NORMAL and depress X-Y START. Observe that the ten frequency markers align with the dark vertical divisions of the X-Y printout.

**System Log Converter Checkout**

a. On the SD301, set SPECTRUM CAL to 0 dB.

b. On the 13175-3, set LIN/LOG switch to LOG and X-Y/GRAM to X-Y.

c. Depress PUSH TO CAL button and adjust the meter for center reading.

d. Set NORMAL/OFF/TEST to NORMAL and depress X-Y START. Observe that the peak of the signal coincides with the top heavy line of the X-Y plot. The printer automatically stops at the end of X-Y plot.

e. Repeat for –10 dB through –40 dB steps.

NOTE

For each 10 dB change, the signal decreases approximately one major division.

# SECTION III
# THEORY OF OPERATION

## 3.1 MODEL 13175-3 BLOCK DIAGRAM DESCRIPTION (See Figure 3-1)

The Models 13175-3/13176 Hard Copy Adapter/Hard Copy Printer provide a hard copy printout of the frequency spectrum from the analyzer. The spectrum is printed on dry electro-sensitive paper as an X-Y plot or a spectrum history printout.

The frequency signal from the analyzer is compressed in the log converter to a logarithmic signal. The operator can select the desired display signal. The selected signal is attenuated by a front-panel potentiometer (CAL) and fed into a conditioning circuit. The conditioner is essentially a slow-responding automatic gain circuit providing gain inversely proportional to the average of the signal.

In the CAL mode (depression of the PUSH TO CAL switch), a Cal signal representing full scale reading is fed into the peak detector circuit. The peak reading is then routed to an 8-bit A/D converter. The digitized peak reading is compared in the peak comparator to a preset full scale reading. The output of the peak comparator is fed into a nulling meter. By adjusting the Cal potentiometer and nulling the meter, the overall gain of the unit is matched to the full scale X-Y display.

In the normal mode of operation, the signal from the conditioner is fed directly to the A/D converter. The A/D converter is an 8-bit successive approximation type converter. The digital signal from the A/D converter is routed to the input multiplexer.

The input multiplexer selects either 4 or 8 bits for storage in the 4X512 RAMs, (Random Access Memory). Four bits of information are used when in GRAM mode while 8 bits are used when in X-Y mode. The 4X512 RAMs are controlled by the memory select logic. The memory select logic consists of the following sections:

a. Memory load logic controls the loading into the memory of a single frequency scan from the analyzer. When in DUAL channel operation, only the selected channel (CH1/CH2 switch) is recorded in the memory by depressing the X-Y START push button.

b. R/W logic provides the signals for reading or writing into the RAMs.

c. Read delay during write disables the readout of data during the writing cycle.

d. Write counter provides the address information for inputting data into the RAMs.

e. Read counter provides the address information for outputting data from the RAMs.

f. Single channel chip select, selects the section of the 4X512 RAM during single channel operation.

g. Dual channel chip select, selects the section of the 4X512 RAM during dual channel operation.

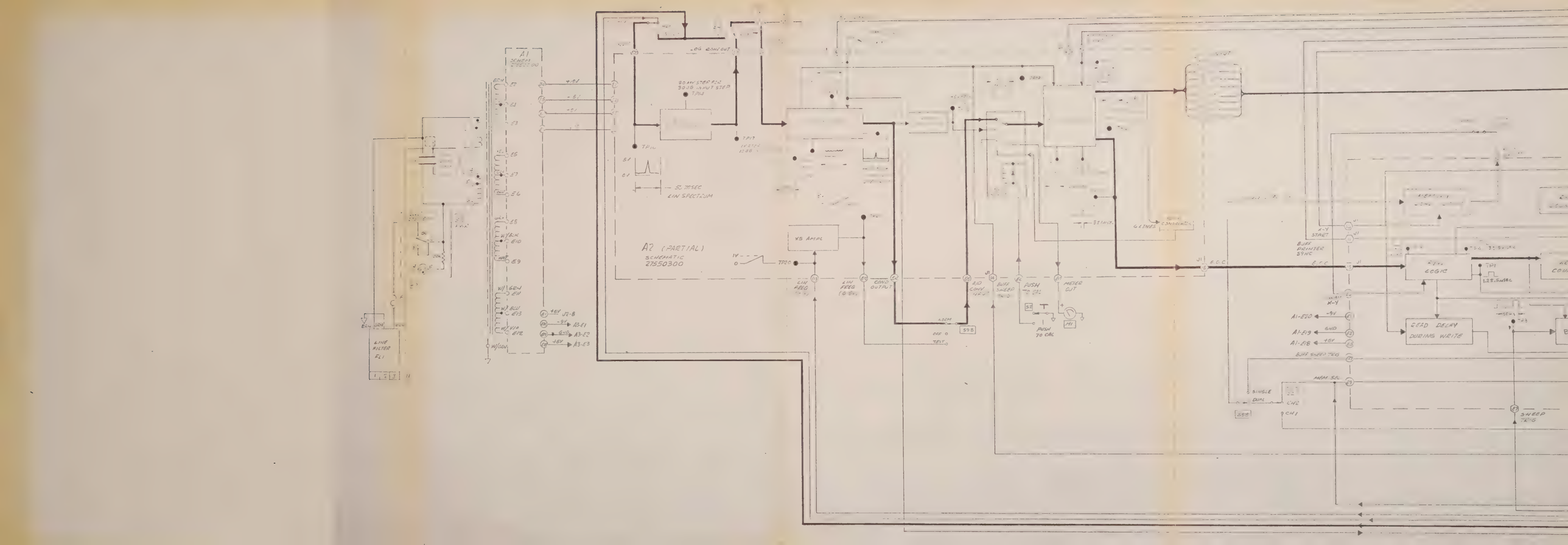
h. Chip select multiplexer selects the desired chip select signal for single or dual channel operation.

The outputs of the RAMs are routed by the output multiplexer to a 4-bit D/A to the write amplifier for a gram printout, or to the digital comparator when in X-Y mode of operation. The digital comparator compares the signal to the output of the line counter. The line counter starts to count beginning with the first line of the printer and provides an 8-bit word for each 4 lines of the printer. The comparator gives an indication when the signal is equal to or greater than the line level. A write signal is initiated for any match or line crossing producing a trace of the signal as the paper in the printer advances. The printer is automatically turned off at the end of 1024 lines by the printer control logic. The write grid logic provides the required signal for the generation of a grid as shown in Figure 1-6.

The scan control logic is a selectable frequency synthesizer providing proper read pulses to the memory select logic for the selected scan speed.

The STYLUS DRIVE and the PAPER DRIVE are also selectable frequency synthesizers that provide the proper clock signals to the Model 13176 stylus and paper drive. The SCAN CONTROL, STYLUS DRIVE, and PAPER DRIVE are controlled by front-panel selectors. The ADVANCE ENABLE overrides the front-panel printer control (NORMAL/OFF/TEST) and enables the printer during paper advance. The CONTRAST control adjusts the output level of the WRITE AMPLIFIER while the BIAS provides a DC offset.

In the TEST mode of operation, a linear 0—5V ramp is fed into the input to provide a test signal for adjusting the printout.


A1
SCHEMA
27550100
LINE FILTER FL1
+15V J2-B
-15V A3-E1
GND A3-E2
+5V A3-E3
LOG CONV OUT
20 MHz STEP RC
30.0 D. INPUT STEP
TP14
TP17
50 MSEC
LIN SPECTRUM
A2 (PARTIAL)
SCHEMATIC
27550300
X5 AMPL
TP20
LIN FREQ
LIN FREQ (0-5V)
CONV OUTPUT
A/D CONV
BUFF SWEEP TRIG
PUSH
PUSH TO CAL
METER CJT
S98
S2
P11
GLITNES
E.O.C
BUFF PRINTER SYNC
X-Y START
E.F.C
X-Y GOGIC
TP1
1.22.5 usec
X-Y
A1-E20
A1-E19
A1-E18
GND
+5V
BUFF SWEEP TRIG
ARM SIG
SINGLE
DUAL
CH2
CH1
S58
SWEEP TRIG
ZERO DELAY
DURING WRITE

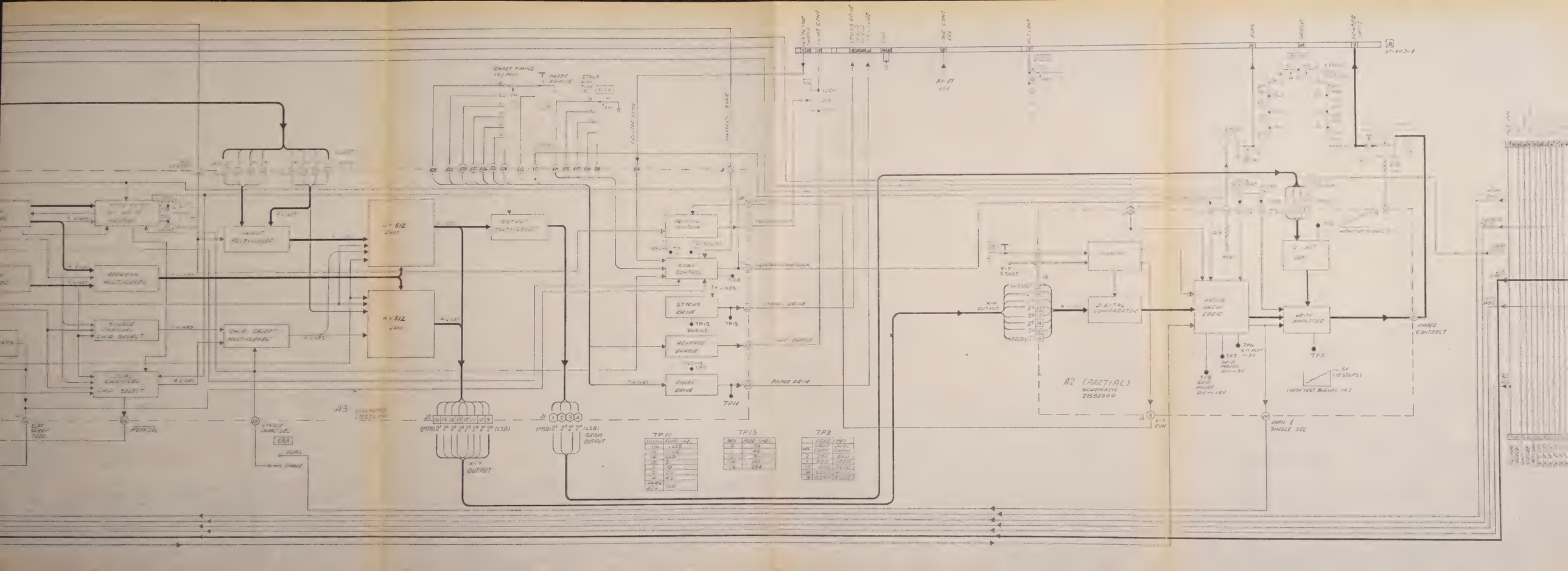


CHART TIMING INJ MUX
PAPER ADVANCE
STYLUS DRIVE TYPE
S13A
ADDRESS MULTIPLEXER
INPUT MULTIPLEXER
4 × 512 RAM
OUTPUT MULTIPLEXER
SCAN CONTROL
STYLUS DRIVE
ADVANCE ENABLE
PAPER DRIVE
SINGLE CHANNEL CHIP SELECT
DUAL CHANNEL CHIP SELECT
DUAL SELECT MULTIPLEXER
A3
J2 (MSB) 2⁷ 2⁶ 2⁵ 2⁴ 2³ 2² 2¹ 2⁰ (LSB)
J1 (MSB) 2³ 2² 2¹ 2⁰ (LSB)
GRAM OUTPUT
K-Y OUTPUT
TP11
TP13
TP8
K-Y START
K-Y OUTPUT
DIGITAL COMPARATOR
A2 (PARTIAL) SCHEMATIC 27550300
WRITE AMPLIFIER
PAPER CONTRAST
TP5
TP6 K-Y REF ~3V
TP7 GRID MAJOR DIV ~3V
TP8 GRID MINOR DIV ~.45V
5V (15STEPS)
(WITH TEST SIGNAL IN)
K-Y RUN
DUAL & SINGLE SEL
S7-403-4

## 3.2 MODEL 13176 BLOCK DIAGRAM DESCRIPTION (See Figure 3-2)

The function of the hard copy recorder is to record sampled data onto roll paper to provide permanent copies. Upon receipt of a linear 15 step staircase waveform (spectrum output) the recorder reproduces up to 15 shades in steps of approximately 2 dB from full black to full white, depending on the spectrum magnitude. The recorder operates from 115 Vac, 60 Hz power (rear panel connector) and is under control of the safety interlocks and the control signals from the Model 13175-3.

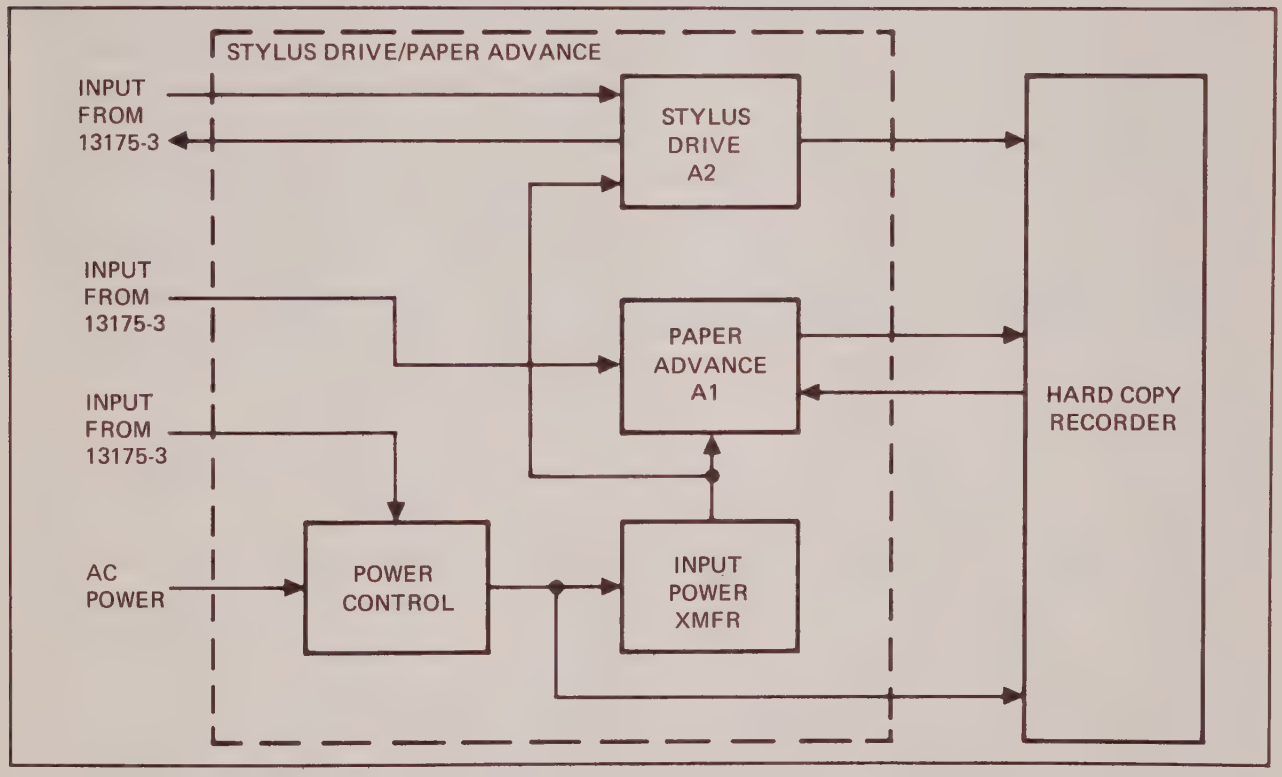



**Figure 3-2. Model 13176 Recorder Block Diagram**

The paper advance and stylus drive circuit is energized by 115 Vac from an AC power connector. The AC line is protected by 2-1/2 amp slow blow fuse. The AC power also energizes the exhaust blower motor. The power coming into the input power transformer is used for generating +15, -15, +80V power and a relay-selectable 25/40V power. These power supplies provide the operating voltages for the paper advance circuit board A1 and the stylus drive circuit board A2.

The +15 and -15V power supply is located in circuit board A2. This board also contains the interlock logic controlling the marker high voltage, the phasing circuit (used for determining the stylus drive A, B, and C phase voltages) and the stylus drive power amplifier. The phase A, B, and C voltages from the power amp are used for driving the sweep speed (stylus) drive motor in the recorder. This circuit uses the stylus drive input and the variable voltage circuit output (25 or 40V) to produce the stylus drive power.

The interlock logic uses the interlock switch inputs to inhibit the printer control and to remove high voltage from the recorder in the event all conditions for safe operation are not met. Phasing pulses from the tachometer are used for generating the printer sync and for synchronizing the printer control input.

The +5V and the +80V power supplies are located in circuit board A1. The phaser and the power amplifiers for producing the paper feed motor voltages SM1, SM2, SM3, and SM4 are located in the circuit board A1. The phase determining circuit is driven by the paper drive input from Model 13175-3. Circuit board A1 also contains the marking control circuit. The marking control circuit is driven by the paper bias and printer spectrum inputs. The marking signal from the output transformer in the marker control circuit is 300V. The stylus drive with DC voltage modulated at 30 kHz is fed into the transformer to get the marking signal. The marking signal goes to the stylus drive and is returned from the printing bar to circuit board A1. Phasing pulses (final slew pulses and lock end pulses) are provided by the record tachometer for syncing purposes. Paper contrast is controlled by the paper bias, paper mark and paper contrast inputs to circuit board A1.

# SECTION IV
# CALIBRATION AND MAINTENANCE

## 4.1 GENERAL

Before calibrating the instrument, the technician is advised to study carefully Section III of this manual. Refer also to the front panel and rear chassis descriptions given in Section I.

All voltage checks and adjustments are made with the circuit cards installed. Located at the rear of this manual, DWG. NO. 27550200 gives the component layout of Circuit Card A1; DWG. NO. 27550500 gives the component layout of Circuit Card A2; and DWG. NO. 27550800 gives the component layout of Circuit Card A3.

Throughout the calibration procedure, calibration controls and parts on a circuit card are referenced by their circuit card and part number alphanumeric designator. For example, on power supply circuit card A1, R5 is referred to as A1R5.

## 4.2 CALIBRATION PROCEDURE

Table 4-1 lists the test equipment required; test equipment having equal or better operational characteristics may be substituted.

**Table 4-1. Test Equipment Required**

| Name | Model No. | Manufacturer |
|---|---|---|
| Digital Voltmeter | 3440A | Hewlett-Packard |
| Frequency Counter | 5223L | Hewlett-Packard |
| Oscilloscope, Dual-Channel with Matched Probes | 503 | Tektronix |
| Variac | V8MT3 | General Radio |
| Attenuator | 350D | Hewlett-Packard |

### 4.2.1 Model 13175-3 Preliminary Setup

a. With power off, check that the 115/230 switch on rear chassis is set properly, and the correct value of fuse is installed.

b. Connect power cord to primary source.

c. Press POWER push button. The front-panel POWER indicator should light indicating the power is on. Allow a 15-minute warmup.

### 4.2.2 Model 13175-3 Power Supply (A1)

a. Connect DVM to A1TP5; measure +15 Vdc (+14.25 to +15.75V).

b. Connect DVM to A1TP4; measure –15 Vdc (–14.25 to –15.75V).

c. Connect DVM to A1TP3; measure –9 Vdc (–8 to –10V).

d. Connect DVM to A1TP2; adjust A1R5 for –5V (–4.9 to –5.1V).

e. Connect DVM to A1TP1; measure +5 Vdc (+4.65 to +5.35V).

f. Using oscilloscope, check ripple at A1TP5, A1TP4, A1TP3, A1TP2, and A1TP1; ripple should be less than 10 mV p-p.

### 4.2.3 Model 13175-3 X-Y Control (A2)

#### 4.2.3.1 Log Converter

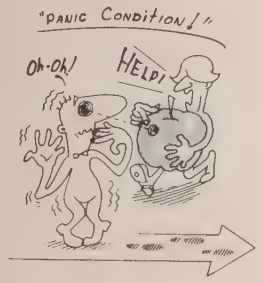
a. Set front panel control; LIN/LOG to LIN, ALI/NORM to ALI.

b. Apply +5.00V, ±.0 Vdc through attenuator to A2TP16.

c. Turn A2R2 Y-CLAMP fully counterclockwise.

d. At A2TP14, measure and record dc voltage changes as attenuator is stepped in 10 dB increments from 0 to 50 dB. Each 10 dB step at input produces approximately 30 mV change at A2TP14. Adjust A2R16 for equal steps at A2TP14.

# TROUBLESHOOTING ON EASY ST.




**PANIC THOUGHTS**

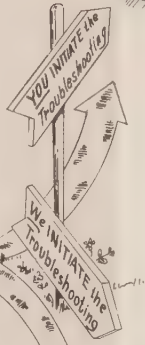
- I've never seen this one before!
- Does anybody know how it happened?
- They probably need it fixed yesterday!
- Who can I ask for help?

**POSITIVE APPROACH**

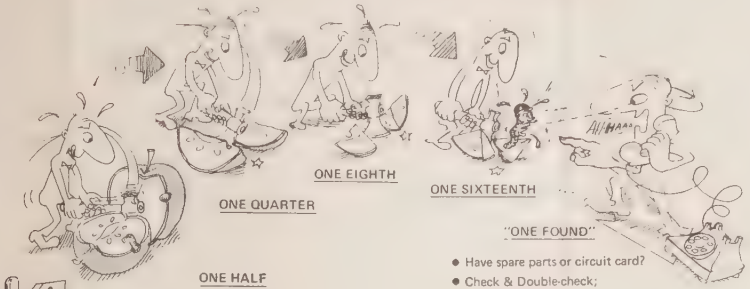
- Problem is probably simple.
- I can fix this problem easily.
- I am going to think logically.
- I am going to carefully evaluate the front panel indications.
- I'll talk to the person who had the problem.

**READY**

- I can whip the problem NOW.




SUCCESSIVE HALF-SPLIT TROUBLESHOOTING METHOD




**ONE HALF**

- Evaluate front panel symptoms before removing cover.
- Look for obvious—simple problem.
- Do not adjust to "FIX" problems!

- Have spare parts or circuit card?
- Check & Double-check; then order parts.
- Prepare for call:
  Have correct part number from part or schematic.
  Have complete Model and Serial Numbers from rear of chassis.

The SDC Customer Service Team is At Your Service Aiming To Please

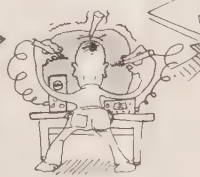
SERVICE IS OUR BUSINESS

**PREPARATION FOR CALL**

- Have talked to person who experienced the problem.
- Have read the manual.
- Have complete Model and Serial Numbers from rear of chassis.

**YOU CALL FOR INSTRUCTIONS**

- We spell out tests.



**YOU PERFORM CHECKOUT**

- As instructed

**WE CALL BACK**

- To Check & Double-check

e. At A2TP17, measure and record dc changes as attenuator is stepped in 10 dB increments from 0 to 50 dB. Each 10 dB step at input produces approximately 1V change at A2TP17. Adjust A2R25 GAIN for equal steps at A2TP14.

f. Adjust A2R27, 0 dB for 0V at A2TP17 with input at –50 dB.

g. With input at –50 dB, adjust A2R2 Y-CLAMP for 0.5V at A2TP17.

#### 4.2.3.2 Conditioner

a. Connect the Model 13175-3 to the SD301, 5001-1, or 5001-6 (see Figure 1-1).

b. Adjust A2R52 AGC level for a 1.6 Vdc level at A2TP11.

c. Set A2S2 to CAL.

d. Set A2S1 to GND.

e. Set front panel X-Y/GRAM switch to X-Y.

f. Adjust A2R36 OFFSET for 0V at A2TP18.

g. Set front panel X-Y/GRAM switch to GRAM.

h. Set A2S1 to +5.

i. Monitor A2TP18 for approximately 5 Vdc. Set A2S1 to GND.

#### 4.2.3.3 A/D Converter

a. Set front panel X-Y/GRAM switch to X-Y.

b. Adjust A2R80 OFFSET for 0 Vdc at A2TP23. (All bits at 0 Vdc.)

c. Set A2S2 to NORM.

d. Set NORM/OFF/TEST to TEST; X-Y/GRAM to GRAM; and SINGLE/DUAL to SINGLE for SD301, 5001-1, or DUAL for 5001-6.

e. Adjust A2R79 FULL SCALE for a 0 to 5V staircase function (255 19.6-mV steps) at A2TP23.

#### 4.2.3.4 4-Bit D/A and Write Amplifier

a. Set A1S1 to CAL.

b. Observe a 0–5V step ramp at A2TP2.

#### 4.2.3.5 Write Grid Logic

a. Set the X-Y/GRAM switch to X-Y.

b. Depress the X-Y START push button.

c. Adjust A2R103 Grid Minor Division for pulses and level changes of approximately 1.2V at A2TP8.

d. Adjust A2R105 Grid Major Division for pulses and level changes of approximately 2.7V at A2TP7.

e. Adjust A2R108 X-Y plot for pulses of approximately 3V at A2TP6.

f. Set A1S1 to OPERATE.

### 4.2.4 Model 13175-3 Scan Converter (A3)

#### 4.2.4.1 Scan Control

a. Adjust A3R25 for 250 $\mu$s, ±10 $\mu$s square wave at A3TP10.

b. Verify frequency at A3TP8 by setting the front panel STYLUS SCAN TIME (SEC) and SINGLE/DUAL switches as shown in Table 4-2.

**Table 4-2. Scan Control Frequency**

| STYLUS SCAN TIME (SEC) | Frequency at A3TP8 (Hz) | |
|---|---|---|
| | SINGLE | DUAL |
| 2 | 250 | 500 |
| 1 | 500 | 1000 |
| 1/2 | 1000 | 2000 |
| 1/4 | 2000 | 4000 |
| 1/8 | 4000 | 8000 |

#### 4.2.4.2 Stylus Drive

a. Adjust A3R21 for 384 Hz, ±4 Hz at A3TP12.

b. Verify frequency at A3TP13 by setting the front panel STYLUS SCAN TIME (SEC) switch as shown in Table 4-3.

**Table 4-3. Stylus Drive Frequency**

| STYLUS SCAN TIME (SEC) | Frequency at A3TP13 (Hz) |
|---|---|
| 2 | 24 |
| 1 | 48 |
| 1/2 | 96 |
| 1/4 | 192 |
| 1/8 | 384 |

#### 4.2.4.3 Paper Drive

a. Adjust A3R34 for 160 Hz, ±2 Hz at A3TP7.

b. Verify frequency at A3TP11 by setting the front panel CHART TIMING (IN/MIN) switch and PAPER ADVANCE button as shown in Table 4-4.

**Table 4-4. Paper Drive Frequency**

| CHART TIMING (IN/MIN) | Frequency at A3TP11 (Hz) |
|---|---|
| 1/16 | .625 |
| 1/8 | 1.25 |
| 1/4 | 2.5 |
| 1/2 | 5 |
| 1 | 10 |
| 2 | 10 |
| 4 | 40 |
| PAPER ADVANCE | 160 |

### 4.2.5 Model 13176 Preliminary Setup

a. With power off, connect P26 to J26 and P27 to J27, and check for correct value of fuse.

b. Connect power cord to primary source.

c. Connect cable 27530600 to J2 of Model 13176, and to J2 of Model 13175-3.

d. Allow 15-minute warmup.

### 4.2.6 Model 13176 Adjustment and Test

a. Set switches and controls on Model 13175-3 as shown in Table 4-5.

**Table 4-5. Control Setting**

| Control | SD301 | 5001-1 | 5001-6 |
|---|---|---|---|
| ALI/NORMAL | NORMAL | NORMAL | NORMAL |
| LIN/LOG | LIN | LIN | LIN |
| SINGLE/DUAL | SINGLE | SINGLE | SINGLE |
| CH1/CH2 | CH1 | CH1 | CH1 |
| X-Y/GRAM | GRAM | GRAM | GRAM |
| NORMAL/OFF/TEST | OFF | OFF | OFF |
| CONTRAST | MID RANGE | MID RANGE | MID RANGE |
| BIAS | MID RANGE | MID RANGE | MID RANGE |
| CHART TIMING | 2 IN/MIN | 2 IN/MIN | 2 IN/MIN |
| STYLUS SCAN TIME | 1/4 SEC | 1/4 SEC | 1/4 SEC |

b. Allow 1/2 hour warmup for best printout.

c. Set NORMAL/OFF/TEST switch to TEST and adjust CONTRAST and BIAS potentiometer for 15 shades of gray from full white to full black (displayed from left to right). For the 5001-6, two shading patterns appear across the scan length.

d. Rotate STYLUS SCAN TIME switch to all positions, and repeat Step c. The writing intensity should remain approximately the same. Return switch to previous setting.

e. Rotate CHART TIMING switch and verify that the paper advances at the selected speeds. Return switch to previous settings.

f. Set SD301, 5001-1, 5001-6 (both channels), to FREQUENCY MARK.

g. Set NORMAL/OFF/TEST switch to NORMAL. Observe ten frequency marker lines. For 5001-6, two sets of ten frequency markers appear across the scan length.

h. If the first marker does not start on the left edge, adjust the tach by loosening the tach adjust Allen-Head screws (2) on Hard Copy stylus drive motor and rotate the Tach Pulley with respect to the stylus belt (See Figure 2-1). Tighten the Allen-Head screws and repeat Step g.

i. Press the PAPER MARK button to write a dark line across the paper.

j. Set the NORMAL/OFF/TEST switch to OFF.

k. On the SD301, turn the FREQUENCY MARKER to OFF and set SPECTRUM CAL to 0 dB. On the 5001-1, set INPUT to TEST. On the 5001-6, set Channel 1 INPUT to TEST, Channel 2 INPUT to an unused input.

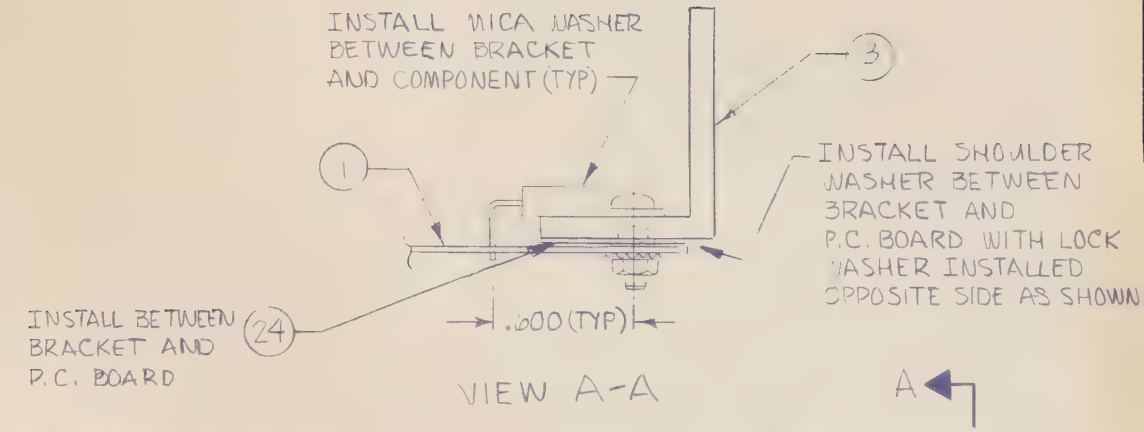
l. Set X-Y/GRAM to X-Y. Depress the PUSH TO CAL button and adjust the meter for center reading.

m. Set NORMAL/OFF/TEST to NORMAL and depress X-Y START. Observe that the peak of the signal coincides with the top heavy line on the X-Y plot. The printer automatically stops at the end of the X-Y plot.

n. Press PAPER ADVANCE. The paper will advance at a fast rate.

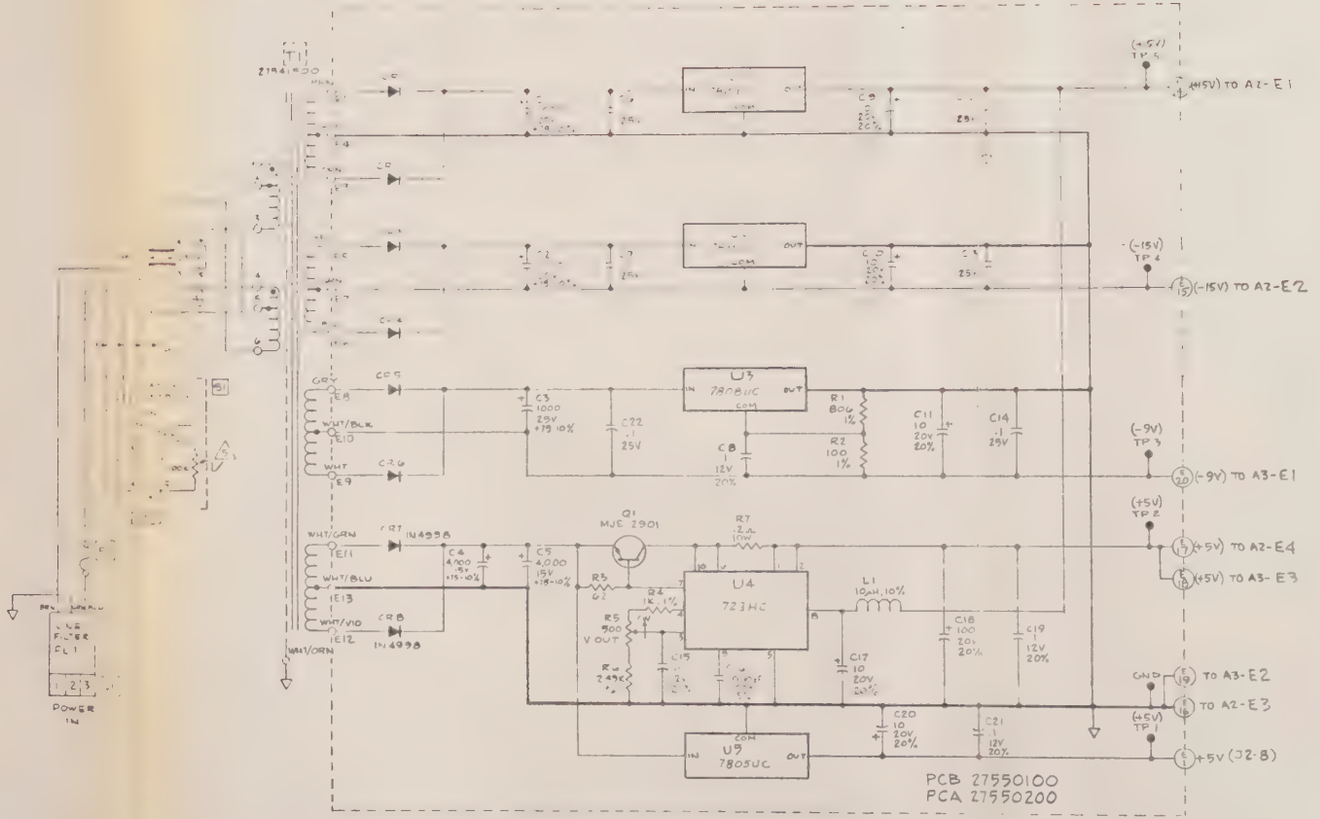
o. Set SD301 FREQUENCY MARKER to ON and SPECTRUM CAL to OPER. Set 5001-1 and 5001-6 (both channels), to FREQUENCY MARK.

p. Set NORMAL/OFF/TEST switch to NORMAL. Depress X-Y START. Observe that the ten frequency markers align with the dark vertical division of the X-Y printout.




| | | | | | |
|---|---|---|---|---|---|
| SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO | TITLE P.C. ASSY POWER SUPPLY | | | SIZE C | MODEL NO. 13175-3 |
| | DRAWN | G. CARR | 5-21-73 | DRAWING NO. 27550200 | REV A |
| | CHECK | R T | 5-23-73 | | |
| | ENGR | [illegible] | 5-24-73 | | |
| | APPR | | | SHEET 4 OF | |

| REV | ECO | S/N | DESCRIPTION | DRAFT | CHECK | APPR |
|---|---|---|---|---|---|---|
| A | — | 011 | RELEASED 7-12-73 | SFZ | | |




NOTES: UNLESS OTHERWISE SPECIFIED

1. (a) RESISTANCE IN OHMS, 5%
   (b) RESISTANCE EQUIVALENT 1/4W, 5%; 1% ARE 1/8W
   (c) CAPACITANCE IN MFD
   (d) CAPACITORS .1μF @ 25V ARE +80-20%
   (e) DIODES ARE IN4383
3. SHOWN [ ] ON LATER FRONT PANEL CONFIGURATION
4. SHOWN [ ] ON ATE CHASSIS LOCATION

5 RESISTOR IS PART OF S1 SW ASSY.

HIGHEST REF DES USED

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMAL ANGULAR
DO NOT SCALE DRAWING
MATERIAL
FINISH

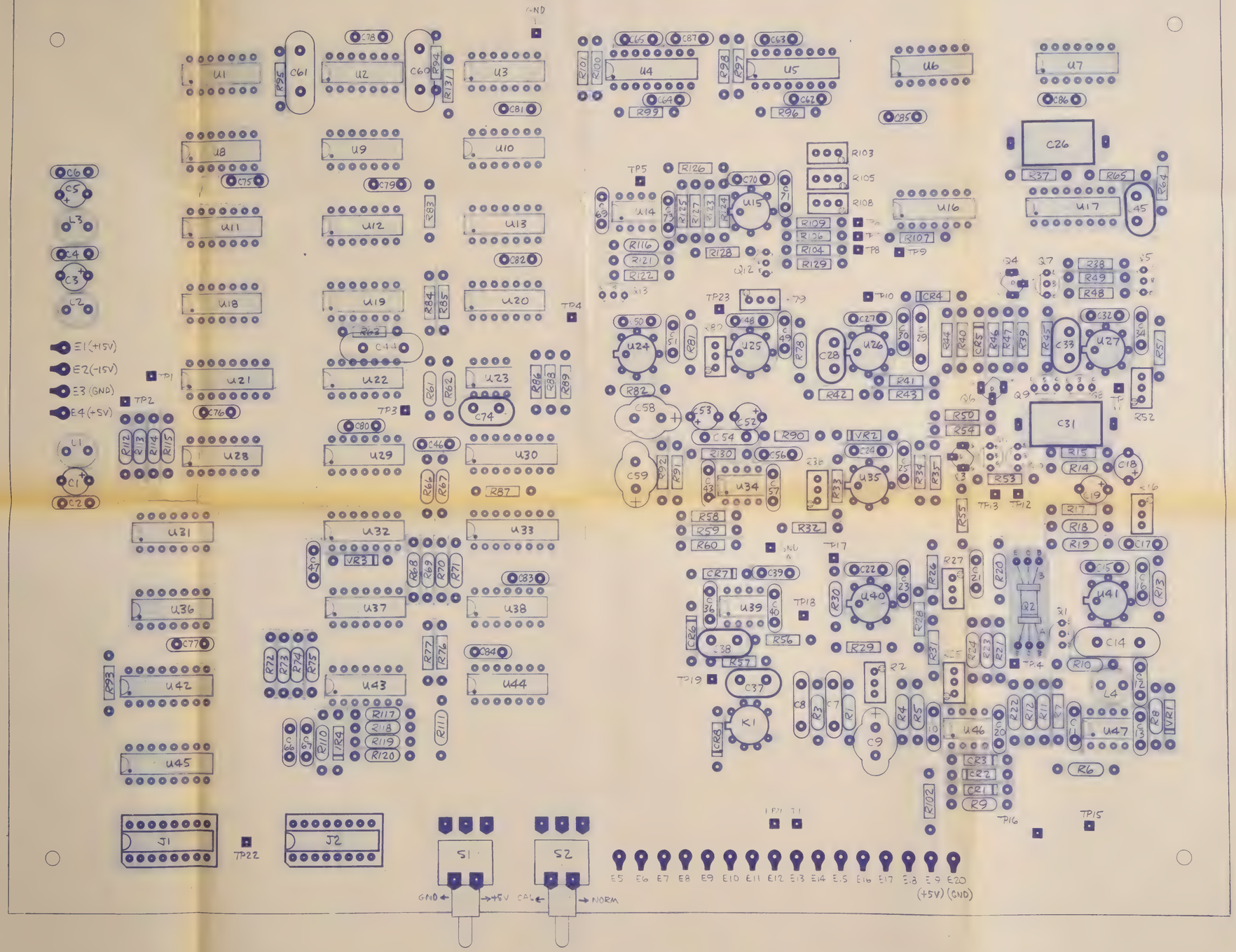
SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

| | | |
|---|---|---|
| DRAWN | | |
| DESIGNER | | |
| CHECKED | | |
| ENGINEER | | |
| APPROVED | | |

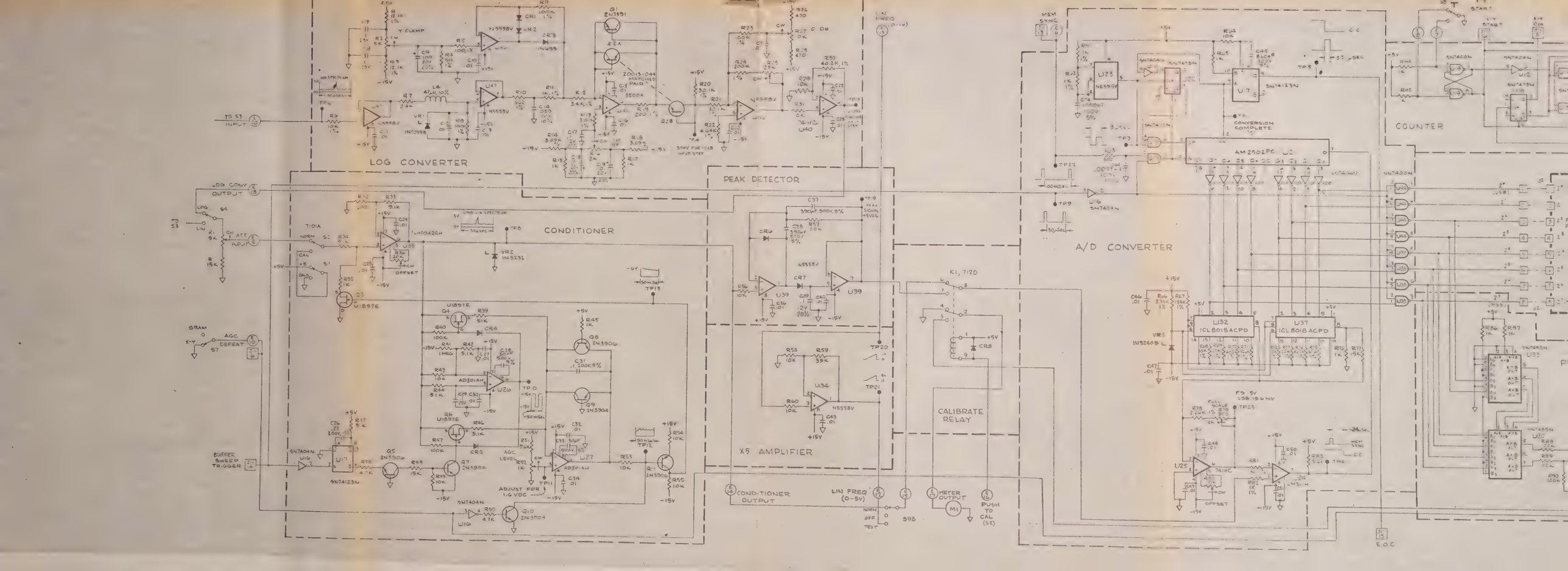
TITLE SCHEMATIC — POWER SUPPLY

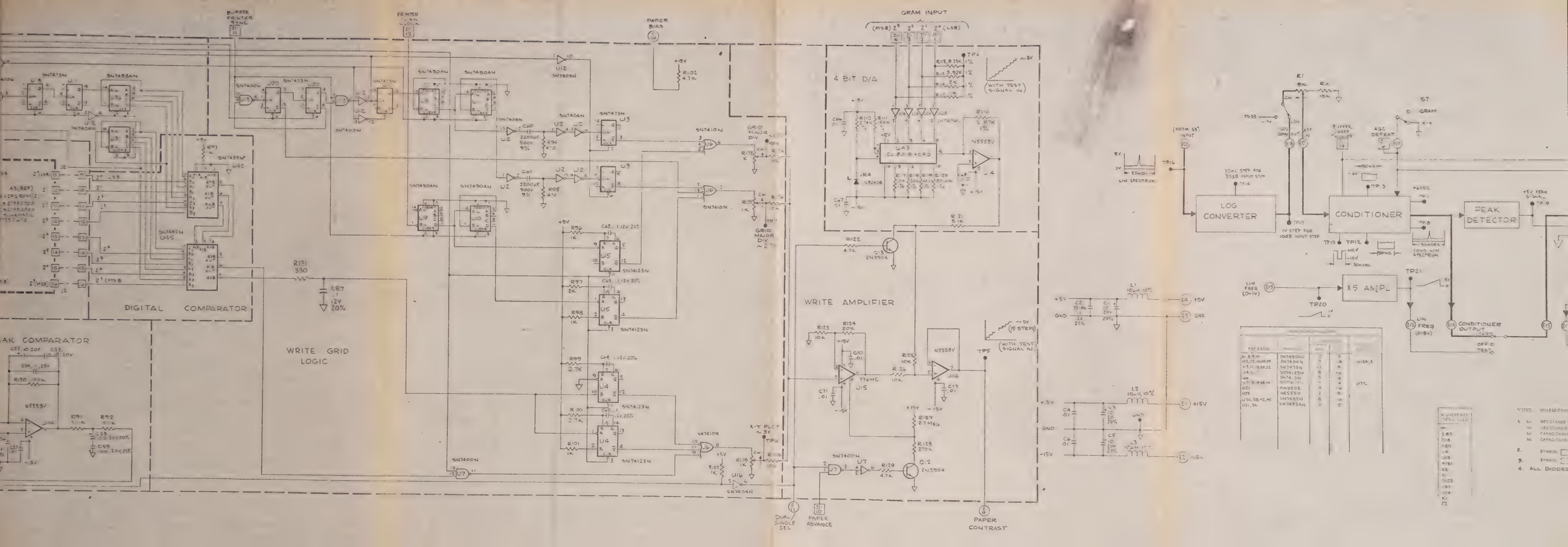
| MODEL | SIZE | DRAWING NO | REV |
|---|---|---|---|
| 13175-3 | D | 27550000 | A |

SCALE ~ SHEET 1 OF 1

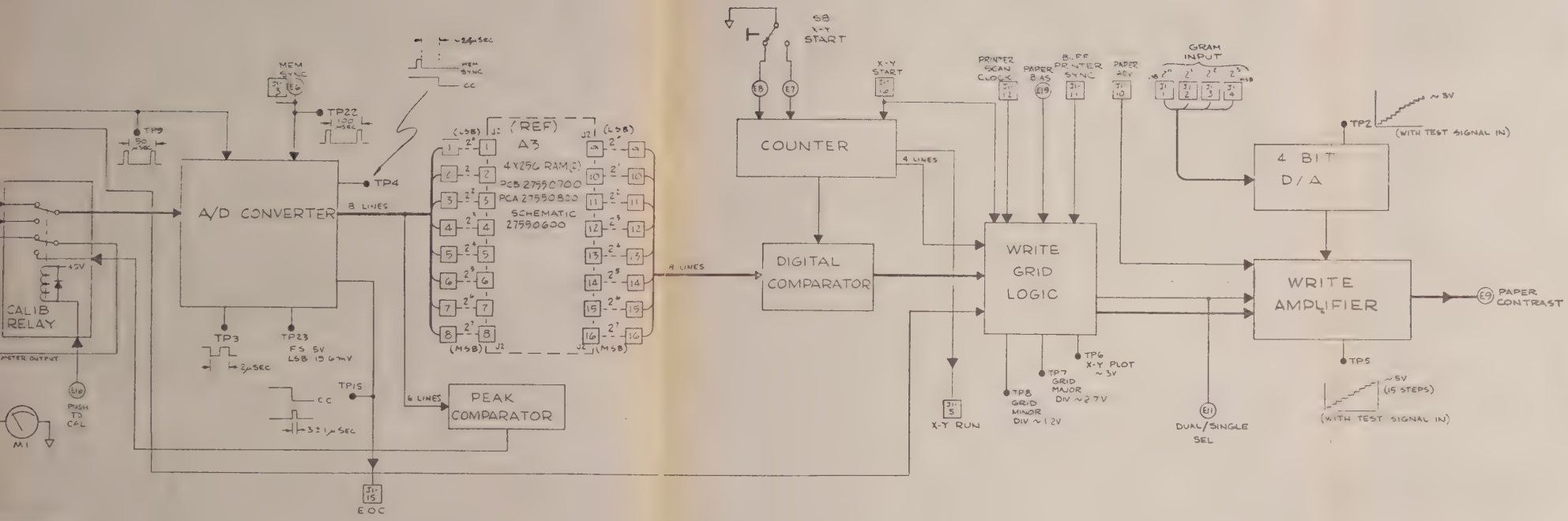



| | | | | | |
|---|---|---|---|---|---|
| SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO | TITLE P.C. ASSY- X-Y CONTROL | | SIZE D | MODEL NO. 13175-3 | |
| | DRAWN | G. CARR 6-26-73 | DRAWING NO. 27550500 | | REV A |
| | CHECK | RT 7-1-73 | | | |
| | ENGR | 7-2-73 | | | |
| | APPR | | SHEET | OF | |


LOG CONVERTER
PEAK DETECTOR
CONDITIONER
X5 AMPLIFIER
A/D CONVERTER
COUNTER
CALIBRATE RELAY
LOG CONV OUTPUT
1 ATT INPUT
CONDITIONER OUTPUT
LIN FREQ (0-5V)
METER OUTPUT
PUSH TO CAL (S2)
BUFFER SWEEP TRIGGER
GRAM
AGC DEFEAT
ADJUST FOR 1.6 VDC
EOC


BUFFER PRINTER SYNC
PRINTER SYNC
PAPER BIAS
GRAM INPUT
(MSB) 2³ 2² 2¹ 2⁰ (LSB)
4 BIT D/A
(WITH TEST SIGNAL IN)
DIGITAL COMPARATOR
WRITE GRID LOGIC
WRITE AMPLIFIER
(WITH TEST SIGNAL IN)
GRID MINOR DIV
GRID MAJOR DIV
X-Y PLOT
DUAL/SINGLE SEL
PAPER ADVANCE
PAPER CONTRAST
LOG CONVERTER
CONDITIONER
PEAK DETECTOR
X5 AMPL
LIN FREQ (0-1V)
LIN FREQ (0-8V)
CONDITIONER OUTPUT
OFF-0
GRAM
AGC DEFEAT
BUFFER SWEEP
LIN SPECTRUM
2ND WIN SPECTRUM
50mSEC
30mSEC
+5V
GND
-15V
+15V

| | | | | | | |
|---|---|---|---|---|---|---|
| A | — | CII | RELEASED | 7-1973 | GJC | RT 7/10/73 |




PCB 27550400
PCA 27550500

A2

| | | |
|---|---|---|
| SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO | TITLE SCHEMATIC X-Y CONTROL | R 3175-3 |
| | SIZE | 27550300 |

29 INSTALL NEARSIDE

1

INSTALL BUS WIRE (3 PLACES)

29 INSTALL NEARSIDE

29 INSTALL NEARSIDE

TP1

TP2

TP3

TP4

TP5

TP6

TP7

TP8

TP9

TP10

TP11

TP12

TP13

GND

GND

GND

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71

C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48

R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37

CR1 CR2

L1 L2 L3

Q1 Q2

S1

J1 J2

PIN 1

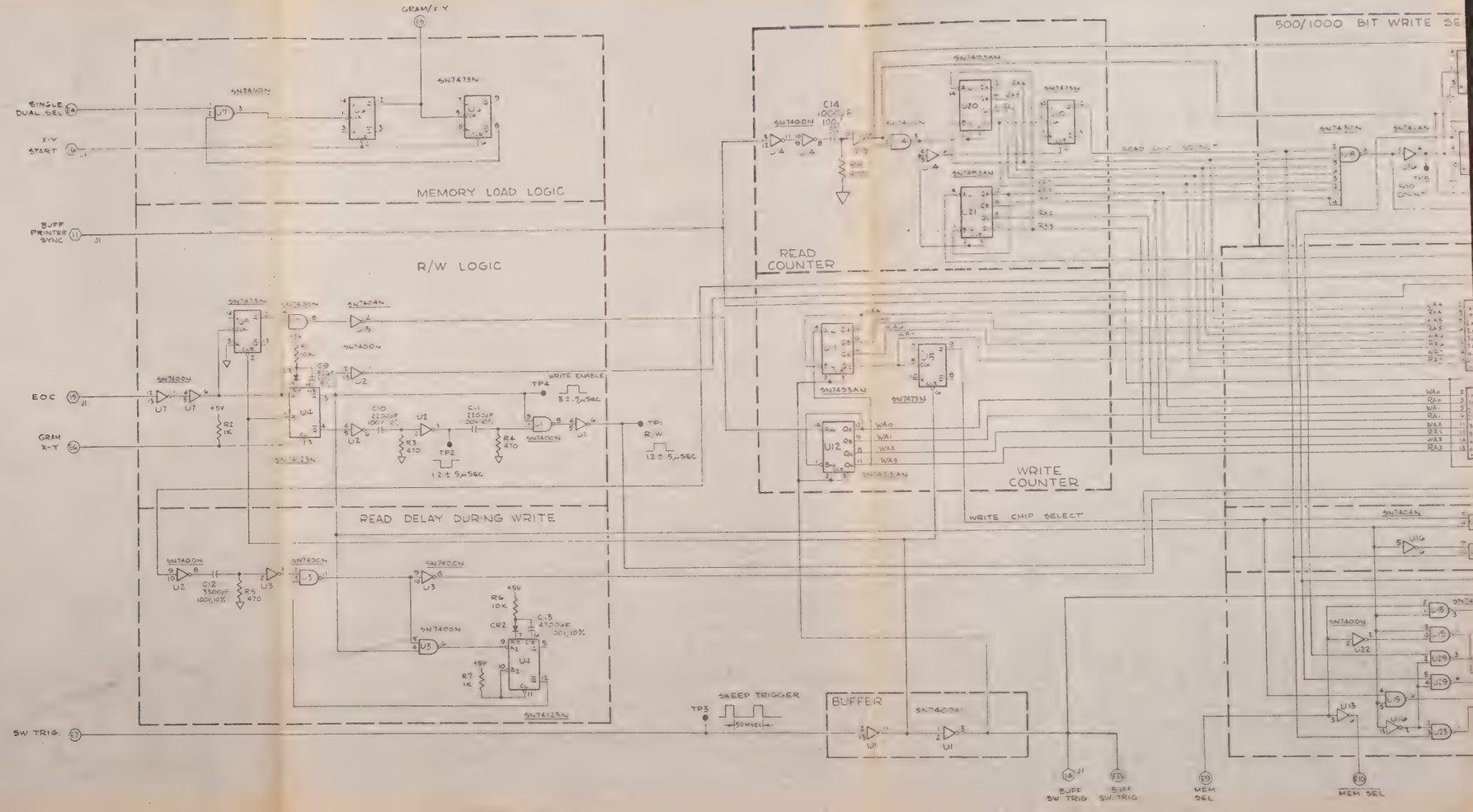
PIN 1

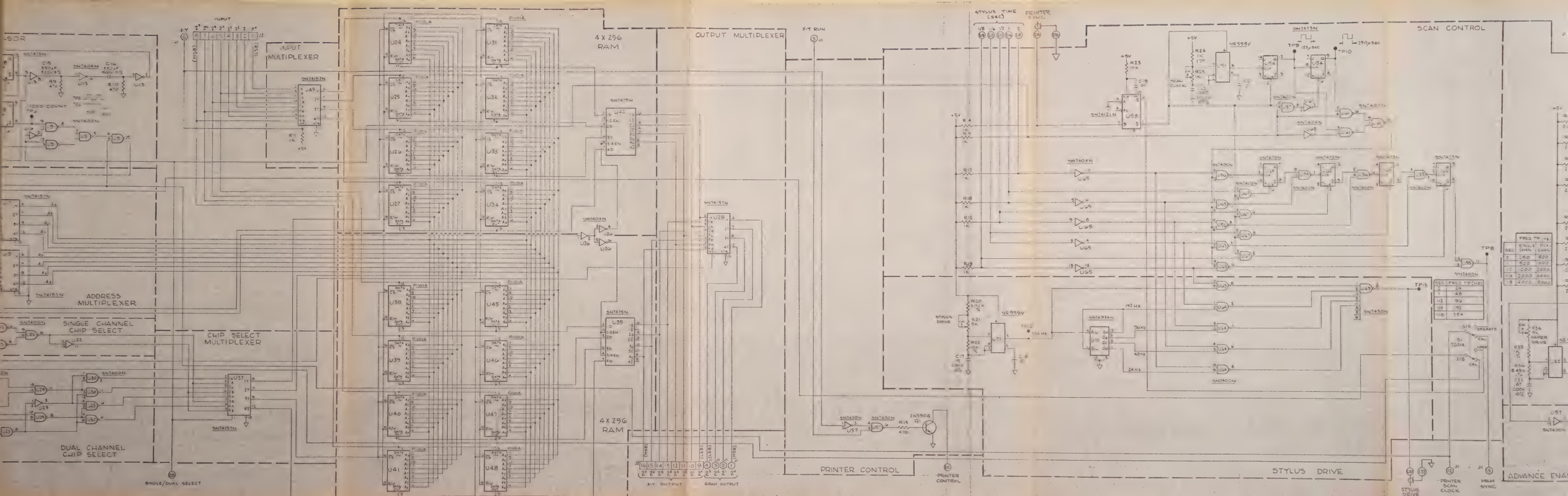
E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11 E12 E13 E14 E15 E16 E17 E18 E19 E20 E21 E22 E23 E24 E25 E26 E27 E28 E29 E30 E31 E32 E33 E34 E35 E36 E37 E38

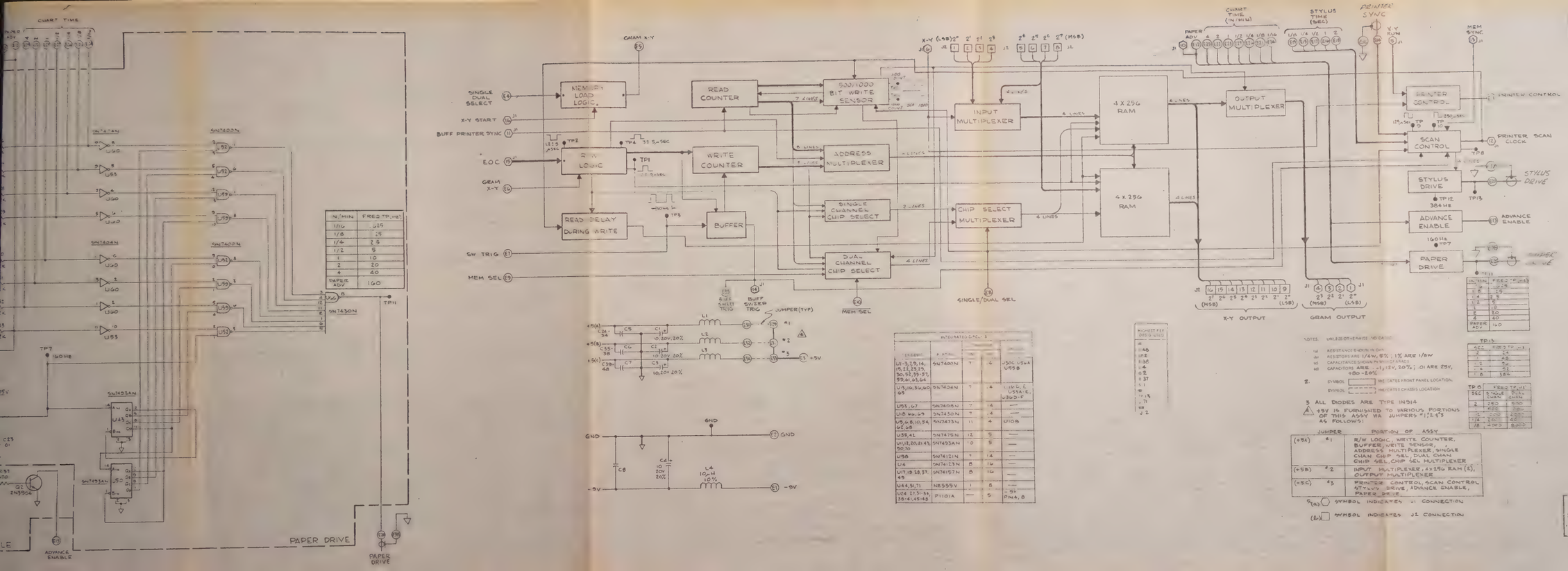
2

2

| | | | | | |
|---|---|---|---|---|---|
| SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO | TITLE PCA SCAN CONVERTER | | | SIZE D | MODEL NO. 13175-3 |
| | DRAWN | G. CARR | 6-6-73 | DRAWING NO. 27550800 | REV A |
| | CHECK | RT | 6-12-73 | | |
| | ENGR | | | | |
| | APPR | | | SHEET 5 OF | |


GRAM/X-Y
SINGLE DUAL SEL
X-Y START
MEMORY LOAD LOGIC
BUFF PRINTER SYNC
R/W LOGIC
EOC
GRAM X-Y
READ DELAY DURING WRITE
SW TRIG.
SWEEP TRIGGER
BUFFER
READ COUNTER
WRITE COUNTER
WRITE CHIP SELECT
500/1000 BIT WRITE SE
WRITE ENABLE
R/W
BUFF SW TRIG
MEM SEL


INPUT MULTIPLEXER
4 X 256 RAM
OUTPUT MULTIPLEXER
X-Y RUN
SCAN CONTROL
ADDRESS MULTIPLEXER
SINGLE CHANNEL CHIP SELECT
CHIP SELECT MULTIPLEXER
DUAL CHANNEL CHIP SELECT
4 X 256 RAM
PRINTER CONTROL
STYLUS DRIVE
ADVANCE ENA
X-Y OUTPUT
GRAM OUTPUT
SINGLE/DUAL SELECT
PRINTER CONTROL
STYLUS DRIVE
PRINTER SCAN CLOCK
MEM SYNC
STYLUS TIME (SEC)
PRINTER SYNC
STYLUS DRIVE
PAPER DRIVE
SCAN CLOCK
FREQ TP (U28)
FREQ TP (U43)




| N/MIN | FREQ TP1 (HZ) |
|---|---|
| 1/16 | .015 |
| 1/8 | .25 |
| 1/4 | 2.5 |
| 1/2 | 5 |
| 1 | 10 |
| 2 | 20 |
| 4 | 40 |
| PAPER ADV | 160 |

| REVISIONS | | | | |
|---|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED | |
| A | RELEASED | 11-7-74 | | |

PCB 27550700
PCA 27550800

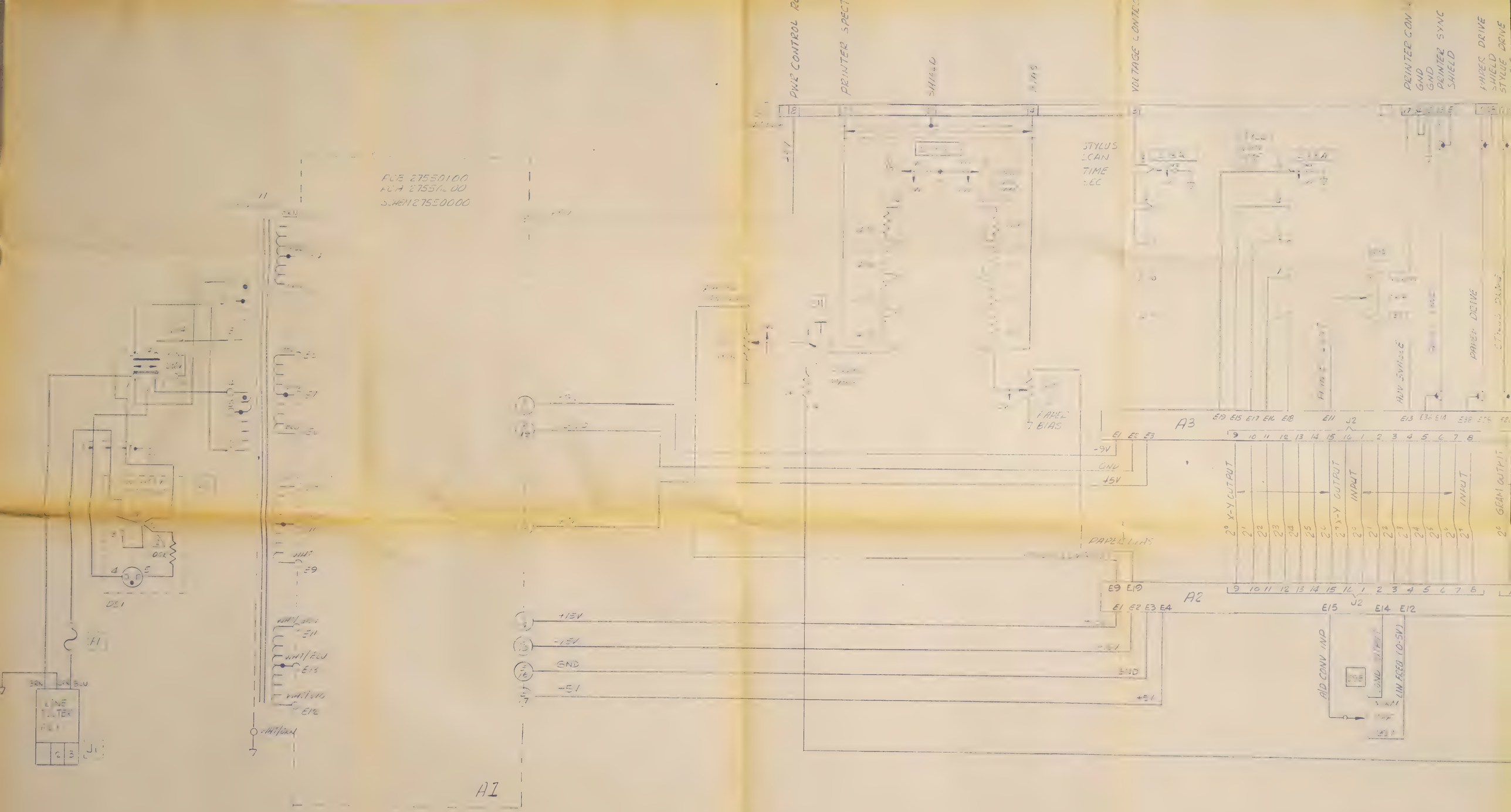
A3

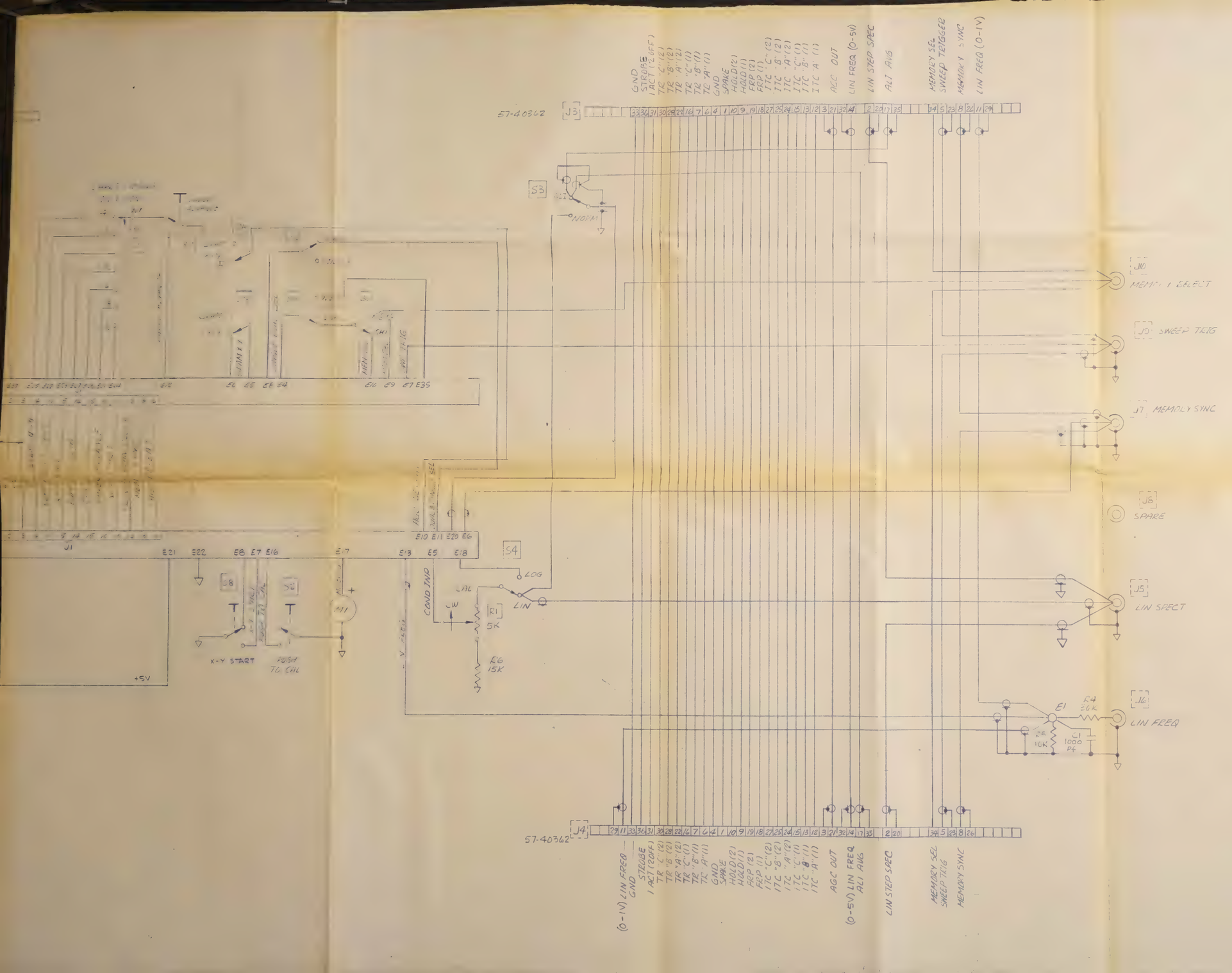
SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

SCHEMATIC SCAN CONV/ PRINTER CONT

R 3175-3

27550600 A


PCB 27550100
PCA 27551100
SCHEM 27550000
PWR CONTROL
PRINTER SPEED
SHIELD
BIAS
STYLUS SCAN TIME SEC
VOLTAGE CONTROL
PRINTER COM
GND
GND
PRINTER SYNC
SHIELD
PAPER DRIVE
SHIELD
STYLUS DRIVE
PAPER DRIVE
ALT SYNC
A3
A2
A1
J1
J2
E1 E2 E3
E9 E10
E11
E13 E16 E14 E12
E15
-9V
GND
+5V
PAPER LIMIT
+15V
-15V
GND
+5V
A/D CONV INP
LINE FEED (0-5V)
X-Y OUTPUT
INPUT
GRAY OUTPUT
LINE FILTER
FL1
DS1
HALT
WHT/BLU
WHT/ORN
WHT/GRN
WHT/BRN
WHT/BLK
WHT/GRY
WHT/VIO
WHT/BLU
WHT/ORN
BRN
GRN
BLU
OSC




NOTES: UNLESS OTHERWISE INDICATED:

1. (a) RESISTANCE SHOWN IN OHMS
   (b) RESISTORS ARE
   (c) CAPACITANCE SHOWN IN MICROFARADS
   (d) CAPACITORS

SYMBOL [ ] INDICATES FRONT PANEL LOCATION.

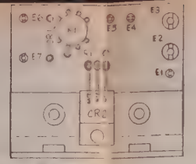
SYMBOL [ ] INDICATES CHASSIS LOCATION.

PART OF E1

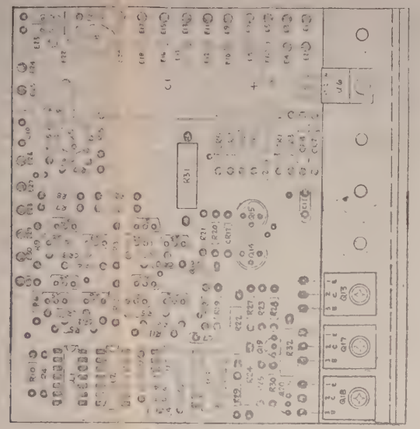
| HIGHEST REF. DESIG. USED |
|---|
| A 3 |
| C 1 |
| ~~CR~~ |
| E 1 |
| ~~L~~ |
| ~~Q~~ |
| R 6 |
| ~~S~~ |
| ~~T~~ |
| ~~TP~~ |
| ~~U~~ |
| ~~VR~~ |

SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

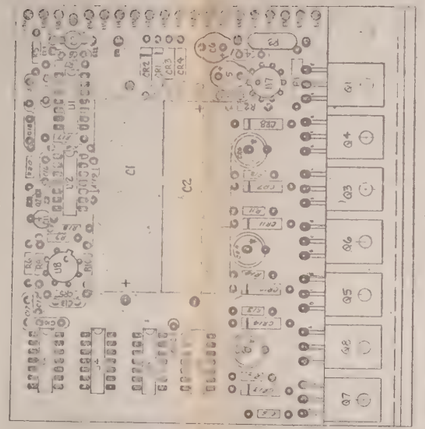
| | | | |
|---|---|---|---|
| TITLE: INTERCONNECT | | SIZE: C | MODEL NO.: 13175-5 |
| DRAWN | TC SMS | 5-22-74 | DRAWING NO.: 27551760 |
| CHECK | [illegible] | [illegible] | REV: A |
| ENGR | [illegible] | 6-4-74 | |
| APPR | [illegible] | 7-27 | SHEET 1 OF 1 |



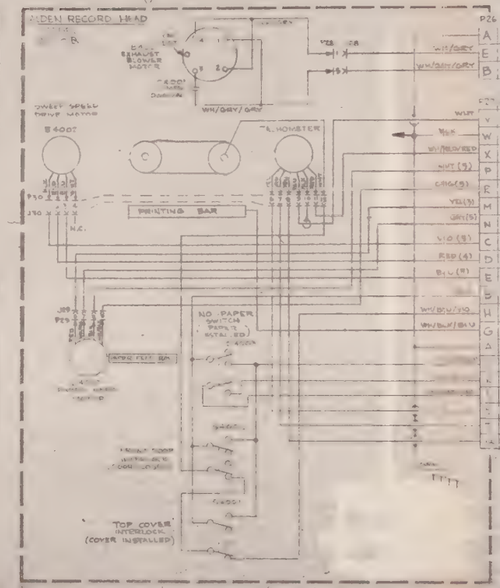
A3 ASSY 27XU800-1

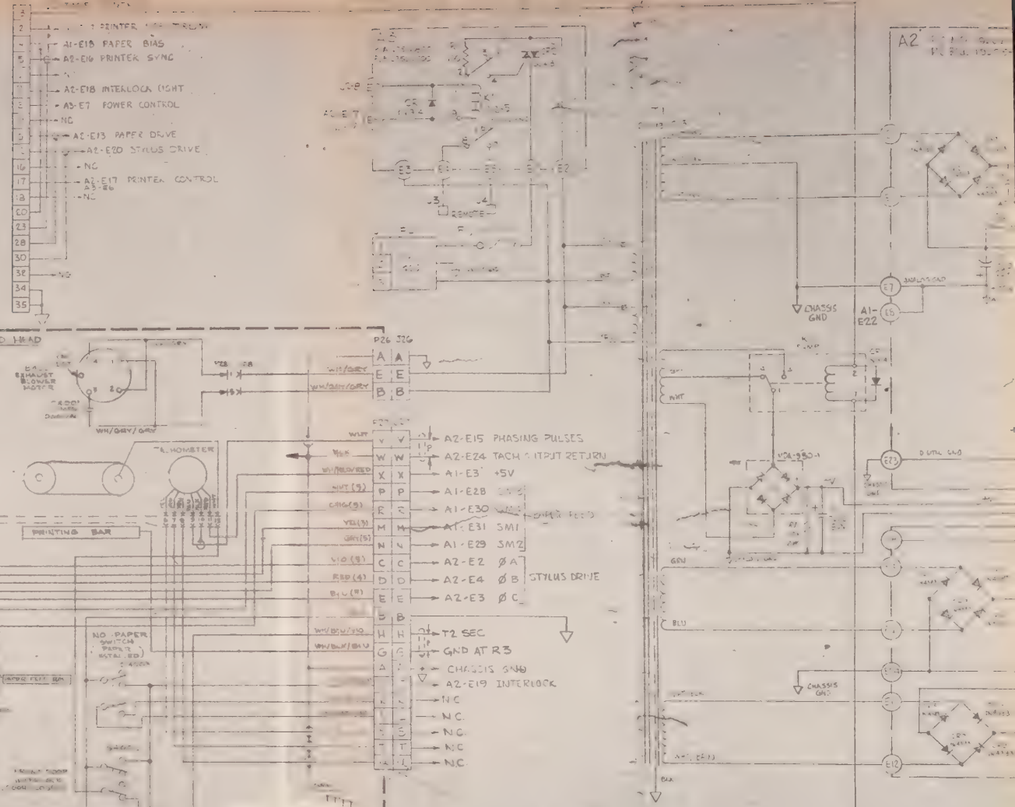


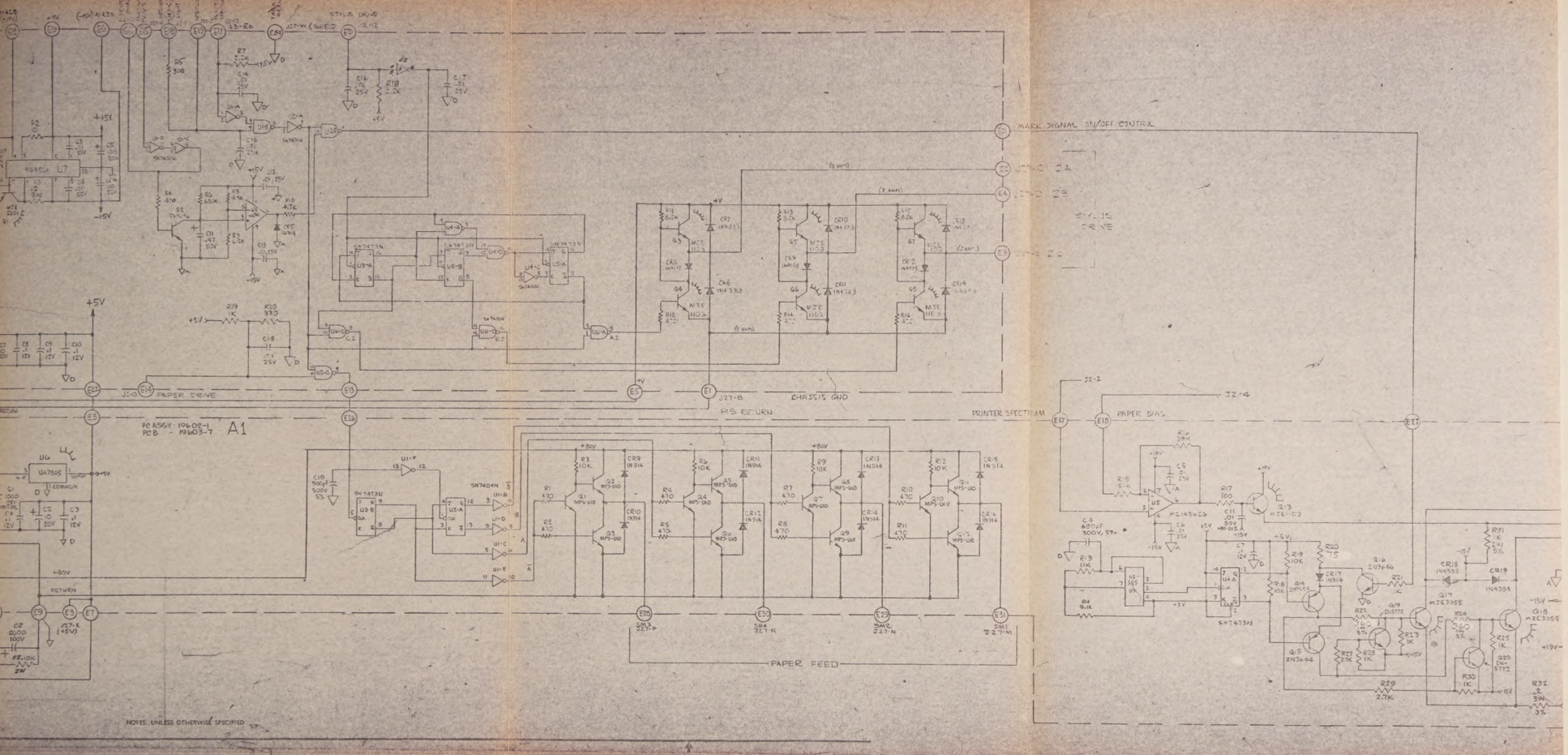
A1 ASSY 19602-1



A2 ASSY 19606-1




STYLUS DRIVE
MARK SIGNAL ON/OFF CONTROL
PAPER DRIVE
CHASSIS GND
P.S. RETURN
PRINTER SPECTRUM
PAPER BIAS
PAPER FEED
PC ASSY 19602-1
PCB - 19603-1 A1
RETURN
+80V
+5V
-15V
NOTES: UNLESS OTHERWISE SPECIFIED